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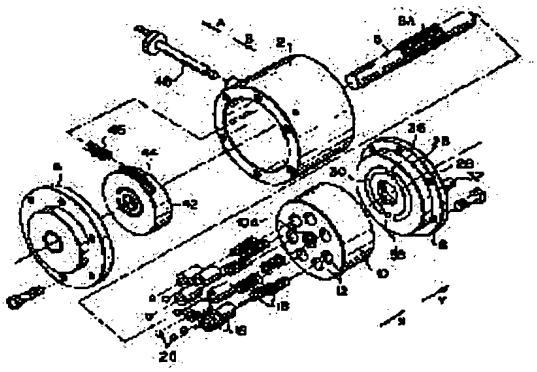
(54) SWASH TYPE PISTON PUMP AND SWASH PLATE TYPE PISTON MOTOR

(57)Abstract:
PURPOSE: To simplify a mechanism, to facilitate miniaturization, and to perform smooth and precise control of a flow rate.
CONSTITUTION: A plurality of cylinders 12 are formed in a cylinder block 10 mounted on a rotary shaft 8 and a piston 16 is contained in each cylinder. The rotary shaft 8 is relatively rotated based on a valve plate member 26 and a swash plate 42 and during the relative rotation, a distance between the part, corresponding to each cylinder 12, of the swash plate 42 and a cylinder 12 is changed in the axial direction of the cylinder. The piston 16 is energized toward the swash plate 42 through the force of a compression coil spring 18. A fluid suction opening 28 and a fluid delivery opening 30 are formed in the valve plate member 26, and the cylinder 12 is communicated alternately with the fluid suction opening 28 and the fluid delivery opening 30. The swash plate 42 is relatively rotatable based on the rotary shaft 8 and rotated by a swash plate rotation operating member 48.



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* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] Two or more cylinders are formed in the cylinder block, and the piston is held in each interior of this cylinder. It has the cam plate made to rotate relatively to the aforementioned cylinder block, and a valve means. The cam side of the aforementioned cam plate is formed so that the distance between the portions and these cylinders corresponding to each aforementioned cylinder may change about the shaft orientations of this cylinder in the case of the aforementioned relative rotation. [in the aforementioned cylinder block], in the circumference of the center of rotation of the aforementioned relative rotation, two or more aforementioned cylinders turn to the direction of this center of rotation, and are arranged. It has an energization means to energize each aforementioned piston to the direction of the cam side of the aforementioned cam plate. The fluid inhalation path and the fluid **** path are formed in the aforementioned valve means, and this fluid inhalation path and the fluid **** path are arranged so that each aforementioned cylinder may be made open for free passage the aforementioned fluid inhalation path and a fluid **** path, and by turns on the occasion of the aforementioned relative rotation. The aforementioned cam plate is a cam plate type axial piston pump characterized by what it is attached so that it can rotate relatively to the aforementioned valve means around the center of rotation of the aforementioned relative rotation, and it has a rotation operation means to operate rotation of this cam plate for.
[Claim 2] It is the cam plate type axial piston pump according to claim 1 which it has the axis of rotation in alignment with the center of rotation of the aforementioned relative rotation, this axis of rotation is attached to the aforementioned valve means and the aforementioned cam plate so that relative rotation may be possible, the aforementioned cylinder block is attached in the aforementioned axis of rotation, and is characterized by making the aforementioned cam plate into a relative rotatable to the aforementioned axis of rotation.
[Claim 3] The aforementioned rotation operation means is a cam plate type axial piston pump according to claim 1 or 2 characterized by being a thing equipped with the worm which gears with the worm gearing formed in the periphery section of the aforementioned cam plate.
[Claim 4] The cam plate type axial piston pump according to claim 1 to 3 characterized by rolling to these between each aforementioned piston and the cam side of the aforementioned cam plate, or the medium member of the shape of a globular form in which sliding rotation is possible intervening.
[Claim 5] The aforementioned energization means is a cam plate type axial piston pump according to claim 1 to 4 characterized by being the compression spring arranged in each aforementioned cylinder.
[Claim 6] In each of 2 pump sections the 1st pump section and the 2nd pump section -- having -- the [these 1st pump section and] -- Two or more cylinders are formed in the cylinder block, and the piston is held in each interior of this cylinder. It has the cam plate made to rotate relatively to the aforementioned cylinder block, and a valve means. The cam side of the aforementioned cam plate is formed so that the distance between the portions and these cylinders corresponding to each aforementioned cylinder may change about the shaft orientations of this cylinder in the case of the aforementioned relative rotation. [in the aforementioned cylinder block], in the circumference of the

center of rotation of the aforementioned relative rotation, two or more aforementioned cylinders turn to the direction of this center of rotation, and are arranged. It has an energization means to energize each aforementioned piston to the direction of the cam side of the aforementioned cam plate. The center of rotation of the aforementioned relative rotation of 2 pump sections has agreed. the [the aforementioned 1st pump section and] -- It has the axis of rotation shared by 2 pump sections. this center of rotation -- meeting -- the [the aforementioned 1st pump section and] -- The valve means of the aforementioned 1st pump section and the valve means of the aforementioned 2nd pump section are shared, and the fluid inhalation path and the fluid regurgitation path are formed. This fluid inhalation path and the fluid regurgitation path are arranged so that each cylinder of 2 pump sections may be made open for free passage the aforementioned fluid inhalation path and a fluid regurgitation path, and by turns on the occasion of the aforementioned relative rotation. the [the aforementioned 1st pump section and] -- Either [at least] the cam plate of the aforementioned 1st pump section or the cam plates of the aforementioned 2nd pump section are attached so that it can rotate relatively to the aforementioned valve means around the center of rotation of the aforementioned relative rotation. Have a rotation operation means to operate rotation of this cam plate, and to the cam plate of the aforementioned valve means and the aforementioned 1st pump section, and the cam plate of the aforementioned 2nd pump section, the aforementioned axis of rotation is attached so that relative rotation may be possible. The cylinder block of the aforementioned 1st pump section and the cylinder block of the aforementioned 2nd pump section are attached in the aforementioned axis of rotation. The cam plate attached so that it could rotate relatively to the aforementioned valve means around the center of rotation of the aforementioned relative rotation is a cam plate type axial piston pump characterized by what is considered as the relative rotatable to the aforementioned axis of rotation.

[Claim 7] The aforementioned rotation operation means is a cam plate type axial piston pump according to claim 6 characterized by being a thing equipped with the worm which gears with the worm gearing formed in the periphery section of the aforementioned cam plate.

[Claim 8] The cam plate type axial piston pump according to claim 6 or 7 characterized by rolling to these between each aforementioned piston and the cam side of the aforementioned cam plate, or the medium member of the shape of a globular form in which sliding rotation is possible intervening.

[Claim 9] The aforementioned energization means is a cam plate type axial piston pump according to claim 6 to 8 characterized by being the compression spring arranged in each aforementioned cylinder.

[Claim 10] Two or more cylinders are formed in the cylinder block, and the 1st piston and the 2nd piston are held in each interior of this cylinder. The 1st cam plate and the 2nd cam plate which are made to rotate relatively to the aforementioned cylinder block are arranged about the shaft orientations of the aforementioned cylinder at the both sides of the aforementioned cylinder block. Each cam side of the 1st cam plate of the above and the 2nd cam plate is formed so that the distance between the portions and these cylinders corresponding to each aforementioned cylinder may change about the shaft orientations of this cylinder in the case of the aforementioned relative rotation. [in the aforementioned cylinder block], in the circumference of the center of rotation of the aforementioned relative rotation, two or more aforementioned cylinders turn to the direction of this center of rotation, and are arranged. It has an energization means to energize the 1st piston of the above, and the 2nd piston to the direction of the cam side of the 1st cam plate of the above, and the cam side of the 2nd means of the above, respectively. It has the valve means you are made to rotate relatively to the aforementioned cylinder block. The fluid inhalation path and the fluid regurgitation path are formed in this valve means. This fluid inhalation path and the fluid regurgitation path are arranged so that it may be made open for free passage through a hole the aforementioned fluid inhalation path and a fluid regurgitation path, and by turns on the occasion of the aforementioned relative rotation. the fluid circulation to which the field between the 1st piston of the above of each aforementioned cylinder and the 2nd piston was formed in the aforementioned cylinder block -- Either [at least] the 1st cam plate of the above or the 2nd cam plate is the cam plate type axial piston pump characterized by what it is attached so that it can rotate relatively to the aforementioned valve means around the center of rotation of the aforementioned relative rotation, and it has a rotation operation means to operate rotation of this cam plate for.

[Claim 11] Have the axis of rotation in alignment with the center of rotation of the aforementioned relative rotation, and to the aforementioned valve means, the 1st cam plate of the above, and the 2nd cam plate, this axis of rotation is attached so that relative rotation may be possible. The cam plate which the aforementioned cylinder block is attached in the aforementioned axis of rotation, and was attached so that it could rotate relatively to the aforementioned valve means around the center of rotation of the aforementioned relative rotation is a cam plate type axial piston pump according to claim 10 characterized by considering as the relative rotatable to the aforementioned axis of rotation.
[Claim 12] The aforementioned rotation operation means is a cam plate type axial piston pump according to claim 10 or 11 characterized by being a thing equipped with the worm which gears with the worm gearing formed in the periphery section of the aforementioned cam plate.
[Claim 13] The cam plate type axial piston pump according to claim 10 to 12 characterized by rolling to these between each aforementioned piston and the cam side of the aforementioned cam plate, or the medium member of the shape of a globular form in which sliding rotation is possible intervening.
[Claim 14] The aforementioned energization means is a cam plate type axial piston pump according to claim 10 to 13 characterized by being the compression spring arranged between the 1st piston of the above, and the 2nd piston in each aforementioned cylinder.
[Claim 15] The swash-plate-type piston motor characterized by having removed the aforementioned energization means of the composition of the cam plate type axial piston pump of a publication to the aforementioned claims 1-4, 6-8, or 10-13, and making a fluid supply path and nothing another side with a fluid eccrisis path for either the aforementioned fluid inhalation path or the fluid regurgitation paths.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to the cam plate type axial piston pump and swash-plate-type piston motor which used the cam plate as a cam member. Especially this invention relates to the piston motor in which the cam plate type axial piston pump and revolving speed control in which control of flow is possible are possible.
[0002]
[Description of the Prior Art] In a cam plate type axial piston pump, the cylinder block and the cam plate have been arranged possible [relative rotation] about a center-of-rotation shaft, the cam side which inclined to the cam plate to the field which intersects perpendicularly with the above-mentioned relative axis of rotation was formed, both-way movement of the piston which was held in the cylinder in a cylinder block by the above-mentioned relative rotation, and was energized to the swash-plate-cam side was carried out within the cylinder, and the pump action is realized.
[0003] Control of flow can be performed by changing the degree of angle of inclination of the cam plate to the above-mentioned relative axis of rotation. However, in order to change the angle of this cam plate itself, it is required to support this cam plate free [rotation] around the rotation shaft which intersects perpendicularly for example, with the above-mentioned relative axis of rotation, and it needs the special rotation shaft for it.
[0004] Therefore, the cam plate type axial piston pump of the method which the degree of angle of inclination of a cam plate is changed, and performs control of flow had become the obstacle of a miniaturization while the mechanism became complicated.
[0005] Not only the above-mentioned cam plate type axial piston pump but in case the above problems control a rotational frequency in a swash-plate-type piston motor with the same basic composition, they exist similarly.
[0006] Then, this invention aims at offering the cam plate type axial piston pump which can realize control of flow and revolving speed control by the easy mechanism, and a swash-plate-type piston motor.
[0007] Furthermore, control of flow and revolving speed control are possible, and this invention aims at a miniaturization offering an easy cam plate type axial piston pump and a swash-plate-type piston motor.

[0008] Furthermore, this invention aims at offering the cam plate type axial piston pump and swash-plate-type piston motor which can perform control of flow and revolving speed control smoothly and precisely.
[0009]
[Means for Solving the Problem] According to this invention, two or more cylinders are formed in the cylinder block as what attains the above-mentioned purpose. The piston is held in each interior of this cylinder, and it has the cam plate made to rotate relatively to the aforementioned cylinder block, and a valve means. The cam side of the aforementioned cam plate is formed so that the distance between the

portions and these cylinders corresponding to each aforementioned cylinder may change about the shaft orientations of this cylinder in the case of the aforementioned relative rotation. [in the aforementioned cylinder block], in the circumference of the center of rotation of the aforementioned relative rotation, two or more aforementioned cylinders turn to the direction of this center of rotation, and are arranged. It has an energization means to energize each aforementioned piston to the direction of the cam side of the aforementioned cam plate. The fluid inhalation path and the fluid regurgitation path are formed in the aforementioned valve means, and this fluid inhalation path and the fluid regurgitation path are arranged so that each aforementioned cylinder may be made open for free passage the aforementioned fluid inhalation path and a fluid regurgitation path, and by turns on the occasion of the aforementioned relative rotation. The aforementioned cam plate is attached so that it can rotate relatively to the aforementioned valve means around the center of rotation of the aforementioned relative rotation, and cam-plate-type-axial-piston-pump ** characterized by what it has a rotation operation means to operate rotation of this cam plate for is offered.

[0010] According to one mode of this invention, it has the axis of rotation in alignment with the center of rotation of the aforementioned relative rotation, to the aforementioned valve means and the aforementioned cam plate, this axis of rotation is attached so that relative rotation may be possible, and the aforementioned cylinder block is attached in the aforementioned axis of rotation, and let the aforementioned cam plate be a relative rotatable to the aforementioned axis of rotation. According to one mode of this invention, the aforementioned energization means is a compression spring arranged in each aforementioned cylinder.

[0011] In each of 2 pump sections moreover -- as what attains the above-mentioned purpose according to this invention -- the 1st pump section and the 2nd pump section -- having -- the [these 1st pump section and] -- Two or more cylinders are formed in the cylinder block, and the piston is held in each interior of this cylinder. It has the cam plate made to rotate relatively to the aforementioned cylinder block, and a valve means. The cam side of the aforementioned cam plate is formed so that the distance between the portions and these cylinders corresponding to each aforementioned cylinder may change about the shaft orientations of this cylinder in the case of the aforementioned relative rotation. [in the aforementioned cylinder block], in the circumference of the center of rotation of the aforementioned relative rotation, two or more aforementioned cylinders turn to the direction of this center of rotation, and are arranged. It has an energization means to energize each aforementioned piston to the direction of the cam side of the aforementioned cam plate. The center of rotation of the aforementioned relative rotation of 2 pump sections has agreed. the [the aforementioned 1st pump section and] -- It has the axis of rotation shared by 2 pump sections. this center of rotation -- meeting -- the [the aforementioned 1st pump section and] -- The valve means of the aforementioned 1st pump section and the valve means of the aforementioned 2nd pump section are shared, and the fluid inhalation path and the fluid **** path are formed. This fluid inhalation path and the fluid **** path are arranged so that each cylinder of 2 pump sections may be made open for free passage the aforementioned fluid inhalation path and a fluid **** path, and by turns on the occasion of the aforementioned relative rotation. the [the aforementioned 1st pump section and] -- Either [at least] the cam plate of the aforementioned 1st pump section or the cam plates of the aforementioned 2nd pump section are attached so that it can rotate relatively to the aforementioned valve means around the center of rotation of the aforementioned relative rotation. Have a rotation operation means to operate rotation of this cam plate, and to the cam plate of the aforementioned valve means and the aforementioned 1st pump section, and the cam plate of the aforementioned 2nd pump section, the aforementioned axis of rotation is attached so that relative rotation may be possible. The cylinder block of the aforementioned 1st pump section and the cylinder block of the aforementioned 2nd pump section are attached in the aforementioned axis of rotation. Cam-plate-type-axial-piston-pump ** characterized by what the cam plate attached so that it could rotate relatively to the aforementioned valve means around the center of rotation of the aforementioned relative rotation is made into the relative rotatable for to the aforementioned axis of rotation is offered.

[0012] According to one mode of this invention, the aforementioned energization means is a compression spring arranged in each aforementioned cylinder.

[0013] Furthermore, according to this invention, two or more cylinders are formed in the cylinder block as what attains the above-mentioned purpose. The 1st piston and the 2nd piston are held in each interior of this cylinder. The 1st cam plate and the 2nd cam plate which are made to rotate relatively to the aforementioned cylinder block are arranged about the shaft orientations of the aforementioned cylinder at the both sides of the aforementioned cylinder block. Each cam side of the 1st cam plate of the above and the 2nd cam plate is formed so that the distance between the portions and these cylinders corresponding to each aforementioned cylinder may change about the shaft orientations of this cylinder in the case of the aforementioned relative rotation. [in the aforementioned cylinder block], in the circumference of the center of rotation of the aforementioned relative rotation, two or more aforementioned cylinders turn to the direction of this center of rotation, and are arranged. It has an energization means to energize the 1st piston of the above, and the 2nd piston to the direction of the cam side of the 1st cam plate of the above, and the cam side of the 2nd means of the above, respectively. It has the valve means you are made to rotate relatively to the aforementioned cylinder block. The fluid inhalation path and the fluid regurgitation path are formed in this valve means. This fluid inhalation path and the fluid regurgitation path are arranged so that it may be made open for free passage through a hole the aforementioned fluid inhalation path and a fluid regurgitation path, and by turns on the occasion of the aforementioned relative rotation. the fluid circulation to which the field between the 1st piston of the above of each aforementioned cylinder and the 2nd piston was formed in the aforementioned cylinder block -- Either [at least] the 1st cam plate of the above or the 2nd cam plate is attached so that it can rotate relatively to the aforementioned valve means around the center of rotation of the aforementioned relative rotation, and cam-plate-type-axial-piston-pump ** characterized by what it has a rotation operation means to operate rotation of this cam plate for is offered.

[0014] It has the axis of rotation in alignment with the center of rotation of the aforementioned relative rotation, to the aforementioned valve means, the 1st cam plate of the above, and the 2nd cam plate, this axis of rotation is attached so that relative rotation may be possible, and the aforementioned cylinder block is attached in the aforementioned axis of rotation, and, according to one mode of this invention, let the cam plate attached so that it might rotate relatively to the aforementioned valve means at the surroundings of the center of rotation of the aforementioned relative rotation be a relative rotatable to the aforementioned axis of rotation. According to one mode of this invention, the aforementioned energization means is a compression spring arranged between the 1st piston of the above, and the 2nd piston in each aforementioned cylinder.

[0015] According to one mode of the above this inventions, the aforementioned rotation operation means is equipped with the worm which gears with the worm gearing formed in the periphery section of the aforementioned cam plate. According to one mode of this invention, between each aforementioned piston and the cam side of the aforementioned cam plate, it rolls to these, or the medium member of the shape of a globular form in which sliding rotation is possible intervenes.

[0016] Furthermore, according to this invention, swash-plate-type piston-motor ** characterized by having removed the aforementioned energization means of the composition of the cam plate type axial piston pump like the above as what attains the above-mentioned purpose, and making a fluid supply path and nothing another side with a fluid eccrisis path for either the aforementioned fluid inhalation path or the fluid regurgitation paths is offered.

[0017]

[Example] Hereafter, the concrete example of this invention is explained, referring to a drawing.

[0018] Drawing 1 is the decomposition perspective diagram showing the 1st example of the cam plate type axial piston pump by this invention, and drawing 2 , drawing 3 , and drawing 4 are the cross sections of the assembly state.

[0019] In these drawings, 2 is the casing fuselage section, 4 and 6 are the casing lid sections, it is combined with a bolt, it is unified and these constitute casing. In casing, the cavity of the shape of a cylindrical shape of the symmetry of revolution centering on the direction of X-Y is formed. In this cavity, the axis of rotation 8 of the direction of X-Y is arranged. This axis of rotation 8 is supported so that it can rotate by the casing lid sections 4 and 6 through bearing, and the edge by the side of the

direction of X has extended out of casing. This axis of rotation 8 has spline 8A in the portion in casing. In addition, in the following explanation, unless shaft orientations, the direction of a path, and a hoop direction have directions especially, all shall point out the direction about the axis of rotation 8.
[0020] In the above-mentioned casing cavity, the cylinder block 10 of an annulus ring configuration is arranged. This cylinder block 10 has spline 8A of the above-mentioned axis of rotation 8, and ******** spline hole 10A in the center section. Seven cylinders 12 are formed in the cylinder block 10 in parallel along the direction of the center of rotation of the axis of rotation 8. These cylinders are equally arranged about the hoop direction of the axis of rotation 8. Opening of these cylinders 12 is carried out in the end face by the side of the direction of X of a cylinder block 10, respectively. moreover -- the end face by the side of the direction of Y of a cylinder block 10 -- each cylinder 12 and free passage **** fluid circulation -- the hole 14 is formed The piston 16 is held in each cylinder 12. Each piston 16 is energized in the direction of X by the compression spring 18 held in the cylinder 12. The spherical-surface seat is formed in the end face by the side of the direction of X of a piston 16, and it holds in this spherical-surface seat so that sliding rotation of sphere 20 may be possible. Penetration formation of the fluid circulation stoma 22 of shaft orientations is carried out through the pars basilaris ossis occipitalis of the above-mentioned spherical-surface seat at the piston 16.
[0021] The casing lid section 6 also has a function as a valve means. Namely, the portion by the side of the direction of X of the casing lid section 6 is formed as valve Itabe material 26. The field by the side of the direction of X of this valve Itabe material 26 is made into the sliding contact surface with the end face by the side of the direction of Y of a cylinder block 10. here -- the above-mentioned fluid circulation -- the fluid inhalation opening 28 and the fluid regurgitation opening 30 which were formed in the hoop direction in the shape of a slot over about a semicircle in the direction position of a path corresponding to a hole 14, respectively are prepared These fluid inhalation opening 28 and the fluid regurgitation opening 30 form the fluid inhalation path and the fluid regurgitation path. The fluid suction pipe 32 and the fluid discharge tube 34 are combined with the casing lid section 6, and these fluid suction pipe 32 and the fluid discharge tube 34 are open for free passage with the above-mentioned fluid inhalation opening 28 and the fluid regurgitation opening 30, respectively. therefore -- if a cylinder block 10 rotates around the axis of rotation 8 -- each cylinder 12 and free passage **** fluid circulation -- a hole 14 runs by maintaining a free passage state by turns one by one to the above-mentioned fluid inhalation opening 28 and the fluid regurgitation opening 30 In the direction position of a path equivalent to the above-mentioned fluid inhalation opening 28 and the fluid regurgitation opening 30, pinholes 36 and 38 are formed among these openings, and the distribution channel currently formed in these pinholes by standing in a row is prolonged to the bearing section for support of the axis of rotation 8.
[0022] In the casing cavity, the strange cam plate (cam member) 42 with the good degree of angle of inclination is arranged. This cam plate 42 is supported so that it can rotate by the axis of rotation 8 through bearing. The field by the side of the direction of Y is set to cam side 42A, and, as for the cam plate 42, the worm gearing 44 is formed in the peripheral face more than over the semicircle at the hoop direction. This worm gearing has geared with the worm 46, and this worm is attached in the rotation operating member 48 inserted by penetrating the casing fuselage section 2 from the outside of casing. This rotation operating member 48 can rotate a cam plate 42 around the axis of rotation 8 by being supported so that it can rotate to the casing fuselage section 2, therefore rotating it.
[0023] in addition, the sphere held in the spherical-surface seat of the piston 22 energized by above-mentioned swash-plate-cam side 42A in the direction of X by the above-mentioned compression spring 18 -- 20 rolls and it is made to contact so that it may be possible
[0024] In the axis of rotation 8 and a cylinder block 10, the clockwise rotation in drawing 4 carries out drive rotation (however, the cylinder block 10 has not appeared in drawing 4). M1 each cylinder 12 is indicated to be in drawing 4 when it is in hoop-direction angle within the limits, a piston 16 and sphere 20 push in the direction of X according to the extension force of the coil spring 18 in a cylinder 12 -- having -- a sphere -- a piston 16 and sphere 20 move in the direction of X, maintaining the contact state of 20 and swash-plate-cam side 42A and one of the cylinders 12 -- fluid circulation -- while it is open for

free passage with the fluid inhalation opening 28 through a hole 14, a fluid (for example, oil) is inhaled into a cylinder 12 through the fluid inhalation opening 28 from the fluid suction pipe 32 (namely, when it is in angle within the limits of N1 shown in drawing 4) M2 [moreover,] each cylinder 12 is indicated to be in drawing 4 the time of being in hoop-direction angle within the limits -- a sphere -- while maintaining the contact state of 20 and swash-plate-cam side 42A -- swash-plate-cam side 42A -- a sphere -- 20 and a piston 16 resist the extension force of the coil spring 18 in a cylinder 12, are pushed in the direction of Y, and move and one of the cylinders 12 -- fluid circulation -- while it is open for free passage with the fluid **** opening 30 through a hole 14, a fluid is breathed out through the fluid **** opening 30 to the fluid discharge tube 34 (namely, when it is in angle within the limits of N2 shown in drawing 4) Suppose that it is the time of a cam plate 42 being in such a hoop-direction angle-of-rotation position hoop-direction angle-of-rotation =0 degree of a cam plate 42.

[0025] That is, it is M1 bordering on m. In a side, a fluid is inhaled from the fluid inhalation opening 28 to a cylinder 12, and it is M2. In a side, a fluid is breathed out from a cylinder 12 to the fluid regurgitation opening 30. This m is made the dead point boundary angular position.

[0026] Drawing 5 is explanatory drawing showing the change of pump operation at the time of changing the hoop-direction angle of rotation theta of a cam plate 42. Drawing 5 (a) is drawing showing how to take the hoop-direction angle of rotation theta of a cam plate 42, and makes the angle at the time of making it rotate to the circumference of the half clock in drawing 3 the hoop-direction angle of rotation theta by operation using the rotation operating member 48 from the state of the 0 degree of the above-mentioned hoop-direction angle of rotation. The distance between swash-plate-cam side 42A in the hoop-direction angular position of a cylinder 12 changes gradually with the increase in the hoop-direction angle of rotation theta. For this reason, the above-mentioned dead point boundary angular position m becomes a clockwise rotation in drawing 4 with the position of which angle theta rotation was done.

[0027] For example, when the fluid regurgitation is made from a cylinder 12 when an angle theta is 45 degrees, the dead point boundary angular position becomes like m', therefore each cylinder 12 is in the position of the direction of a counterclockwise rotation from m' in drawing 4 to the fluid inhalation opening 28, and each cylinder 12 is in the position of the direction of a clockwise rotation in drawing 4 from m', fluid inhalation is made to a cylinder 12. Therefore, the fluid of the amount equivalent to the difference of the amount of fluid inhalation from the fluid inhalation opening 28 to a cylinder 12 and the fluid discharge quantity from the cylinder 12 to the fluid inhalation opening 28 will be inhaled from the fluid suction pipe 32 to the fluid inhalation opening 28. When similarly fluid inhalation is made to a cylinder 12 when each cylinder 12 is in the position of the direction of a counterclockwise rotation from m' in drawing 4 to the fluid regurgitation opening 30, and each cylinder 12 is in the position of the direction of a clockwise rotation in drawing 4 from m', the fluid regurgitation is made from a cylinder 12. Therefore, the fluid of the amount equivalent to the difference of the fluid discharge quantity from the cylinder 12 to the fluid regurgitation opening 30 and the amount of fluid inhalation from the fluid regurgitation opening 30 to a cylinder 12 will be breathed out from the fluid discharge tube 34 to the fluid regurgitation opening 30.

[0028] Since the amount of fluid inhalation from the fluid inhalation opening 28 to a cylinder 12 and the fluid discharge quantity from the cylinder 12 to the fluid inhalation opening 28 become equal in this way when an angle theta is 90 degrees, the fluid inflow to the fluid inhalation opening 28 from the fluid suction pipe 32 is lost. Since the amount of fluid inhalation from the fluid regurgitation opening 30 to a cylinder 12 and the fluid discharge quantity from the cylinder 12 to the fluid regurgitation opening 30 become equal, the fluid regurgitation from the fluid regurgitation opening 30 to the fluid discharge tube 34 is also lost.

[0029] An operation with the fluid suction pipe 32 and the fluid discharge tube 34 reverses [an angle theta] before 180 degrees exceeding 90 degrees, a fluid is breathed out to the fluid suction pipe 32, and a fluid is inhaled from the fluid discharge tube 34.

[0030] Drawing 5 (b) shows the outline of the relation between an angle theta and the amount of fluid circulation. Curve C1 The amount of fluid inhalation from the fluid suction pipe 32 is shown (+ shows

inhalation and - shows the regurgitation), and it is a curve C2. The fluid discharge quantity to the fluid discharge tube 34 is shown (- shows the regurgitation and + shows an inflow).
[0031] In addition, by explanation of the more than related with drawing 5 , infinitely, a near number of cylinders 12 made the model in the hoop direction per gestalt of the limit infinitely arranged at the small interval, and explained to it.
[0032] In this example, since a fluid is supplied into a spherical-surface seat through the circulation stoma 22, the lubrication action between sphere 20 is performed good as this spherical-surface seat. Moreover, the hoop-direction angle range in which each cylinder 12 stops opening any of the fluid inhalation opening 28 and the fluid regurgitation opening 30 for free passage existed, and although there is discontinuous fear of operation by the fluid regurgitation from a cylinder 12 being blocked especially in these angle ranges, the discharge-flow object from a cylinder 12 is received in above-mentioned angle within the limits by forming pinholes 36 and 38 in the above-mentioned example. Thereby, the lubrication of bearing is also realizable while being able to make pump operation perform continuously and smoothly.
[0033] As mentioned above, in this example, to the axis of rotation 8 of a cylinder block's 10 rotation sake, it can attach so that rotation and rotation of a cam plate 42 may be possible, and the amount of fluid circulation (discharge quantity) can be controlled by setting up suitably the surrounding hoop-direction rotation position of the axis of rotation 8 of this cam plate easily and correctly. Especially, in this example, since the change of the amount of circulation to an angle of rotation theta is small in theta= 0-degree near, there is the special feature that the amount of circulation is precisely [smoothly and] controllable near the amount of the maximum circulation. Moreover, in this example, since the cam plate 42 is attached in the axis of rotation 8 possible [rotation], it is not necessary to establish a special rotation shaft, and there are few necessary members, it ends, a mechanism is easy, and a miniaturization is easy.
[0034] moreover -- above -- this example -- setting -- between each piston 16 and swash-plate-cam side 42A -- a sphere, since 20 is arranged Even if the direction of the force which sphere 20 receives from cam side 42A differs from the direction of a cylinder 12 and a piston 16 strictly Since only the force of the direction of a cylinder 12 and a piston 16 is applied to the piston 16 which is carrying out field contact with the cylinder 12 from sphere 20 As for this thing, a parenchyma top does not have a lateral pressure to a cylinder 12 as the length of a piston 16 is short. Therefore, that it is hard to generate the fluid leakage by which wear of a cylinder and a piston passes along between a cylinder-piston few, pump efficiency is maintained highly, and has little oscillating generating, and the operation effect that it can moreover miniaturize is acquired.
[0035] Drawing 6 and drawing 7 are the decomposition perspective diagrams showing the 2nd example of the cam plate type axial piston pump by this invention, and drawing 8 , drawing 9 , and drawing 10 are the cross sections of the assembly state. In these drawings, the same sign is given to the member which has the same function also in above-mentioned drawing 1 - drawing 5 . In addition, drawing 7 constitutes a part of drawing 6 (P-Q portion).
[0036] In this example, it sets in a casing cavity, and is the 1st pump section S1 by the side of the direction of X. The 2nd pump section S2 by the side of the direction of Y Two functional divisions are arranged. The 1st pump section S1 It has the same composition as the functional division of the 1st example of the above. Moreover, the 2nd pump section S2 The point that the cam plate is being fixed to casing is removed, and it is the 1st pump section S1. It has the same composition. namely, the 2nd pump section S2 the cylinder block 11 which can be set, spline hole 11A, a cylinder 13, and fluid circulation -- a hole 15, a piston 17, a compression spring 19, and a sphere -- 21, a cam plate 43, and cam side 43A -- respectively -- the 1st pump section S1 the cylinder block 10 which can be set, spline hole 10A, a cylinder 12, and fluid circulation -- a hole 14, a piston 16, a compression spring 18, and a However, the 2nd pump section S2 The cam plate 43 is being fixed to the casing lid section 6.
[0037] And the 1st pump section S1 The 2nd pump section S2 The valve Itabe material 27 currently shared in the two pump sections is fixed and arranged to the casing fuselage section 2 at the boundary section. this ports plate -- let the field by the side of the direction of X of a member 27, and the field by

the side of the direction of Y be an end face by the side of the direction of Y of a cylinder block 10, and the sliding contact surface with the end face by the side of the direction of X of a cylinder block 11, respectively -- having -- **** -- here -- the above-mentioned fluid circulation -- the fluid inhalation opening 28 and the fluid regurgitation opening 30 which were formed in the hoop direction in the shape of a slot over about a semicircle in the direction position of a path corresponding to These fluid inhalation opening 28 and the fluid regurgitation opening 30 are penetrated in the XY direction. And the casing fuselage section 2 and the valve Itabe material 27 are penetrated in the AB direction, and the fluid suction pipe 32 and the fluid discharge tube 34 are connected to these inhalation opening and regurgitation opening, respectively. In the direction position of a path equivalent to the above-mentioned fluid inhalation opening 28 and the fluid regurgitation opening 30, pinholes 36 and 38 are formed among these openings, and the distribution channel currently formed in these pinholes by standing in a row is prolonged to opening of the penetration **** XY direction of the axis of rotation 8.

[0038] The axis of rotation 8 is the 1st pump section S1. The 2nd pump section S2 It is used in common, and the above-mentioned cylinder blocks 10 and 11 are attached in the axis of rotation 8 so that the cylinders 12 and 13 of five each which was formed in cylinder blocks 10 and 11 may be located corresponding to the XY direction. Therefore, the corresponding cylinders 12 and 13 are simultaneously open for free passage with the fluid inhalation opening 28 and the fluid regurgitation opening 30 with rotation of the axis of rotation 8.

[0039] The 1st pump section S1 As how to take the hoop-direction angle of rotation theta of a cam plate 42, it is the 2nd pump section S2 as cam side 42A is shown in drawing 8 . When the time of being in cam side 43A of the fixed cam plate 43 and symmetrical arrangement is made into 0 degree, the relation between change of the hoop-direction angle of rotation theta and change of pump operation comes to be shown in drawing 11 . Curve C1 The amount of fluid inhalation from the fluid suction pipe 32 is shown (+ shows inhalation and - shows the regurgitation), and it is a curve C2. The fluid discharge quantity to the fluid discharge tube 34 is shown (- shows the regurgitation and + shows an inflow). When an angle theta becomes 180 degrees, it is the 1st pump section S1. Swash-plate-cam side 42A and the 2nd pump section S2 Even if an interval with swash-plate-cam side 43A becomes fixed in all hoop-direction angles, therefore the axis of rotation 8 and a cylinder block rotate Since the interval of the corresponding pistons 16 and 17 will not change, the fluid regurgitation to the fluid inhalation and the fluid regurgitation opening 30 from cylinders 12 and 13 from the fluid inhalation opening 28 to cylinders 12 and 13 is lost. The fluid inflow to the fluid inhalation opening 28 from the fluid suction pipe 32 and the fluid regurgitation from the fluid regurgitation opening 30 to the fluid discharge tube 34 are lost.

[0040] In addition, by drawing 11 , infinitely, a near number of cylinders 12 made the model in the hoop direction per gestalt of the limit infinitely arranged at the small interval, and explained to it.

[0041] Also in this example, the same operation effect as the 1st example of the above is attained. A fluid can be inhaled from the fluid suction pipe 32, and a fluid can be made to breathe out from the fluid discharge tube 34 in this example in the range whose angle theta is 0 degree - 180 degrees. Moreover, in the case of this example, the flow rate of the double precision of the 1st example of the above is obtained. In addition, it sets in the example of **** 2 and is the above-mentioned 2nd pump section S2. It is the 1st pump section S1 about a cam plate 43. It can also consider as what can rotate like a cam plate 42.

[0042] Drawing 12 and drawing 13 are the decomposition perspective diagrams showing the 3rd example of the cam plate type axial piston pump by this invention, and drawing 14 and drawing 15 are the cross sections of the assembly state. In these drawings, the same sign is given to the same member also in above-mentioned drawing 1 - drawing 11 . In addition, drawing 13 constitutes a part of drawing 12 (P-Q portion).

[0043] In this example, the valve Itabe material 27 used in the 2nd example of the above is removed, and the common unification of the compression spring in the cylinder corresponding to [in this cylinder block] two cylinder block rows and this cylinder is carried out instead of. That is, the 1st and 2nd pistons 16 and 17 were held in each one cylinder 12 of a cylinder block 10, and one compression spring 18 is arranged to the field in a cylinder between the pistons which these-correspond. And the fluid

inhalation slot 29 and the fluid regurgitation slot 31 as a substitute of fluid inhalation opening used in the 2nd example of the above and fluid regurgitation opening are formed in the inside of the casing fuselage section 2 over about a semicircle at a hoop direction, respectively. the shaft-orientations position corresponding to these -- setting -- a cylinder block 10 -- the 1st of each cylinder and the 2nd piston 16, the field between 17, and free passage **** fluid circulation -- the hole 15 is formed And the casing fuselage section 2 is penetrated in the above-mentioned fluid inhalation slot 29 and the fluid regurgitation slot 31, and the fluid suction pipe 32 and the fluid discharge tube 34 are connected to them, respectively.

[0044] Also in this example, the same operation effect as the 2nd example of the above is attained. Furthermore, at this example, since a ports-plate member is omitted and the valve means is formed in the casing fuselage section 2, there are few part mark.

[0045] As mentioned above, although the example of the ** piston pump which carries out drive rotation of the axis of rotation 8, inhales a fluid from the fluid suction pipe 32, and breathes out a fluid from the fluid discharge tube 34 was explained, the piston motor made to rotate the axis of rotation 8 as an output shaft can be constituted by removing the energization means slack compression spring for the piston energization in these piston pumps, and introducing a high-pressure fluid from either the fluid suction pipe 32 or the fluid discharge tubes 34, and discharging a fluid from another side. In such a piston motor, the same operation effect as what transposed the control of flow in the operation effect explained per each example of the above-mentioned piston pump to revolving speed control is acquired.

[0046]

[Effect of the Invention] As mentioned above, since according to the cam plate type axial piston pump and swash-plate-type piston motor of this invention it attached so that the above-mentioned cam plate could be relatively rotated to the above-mentioned valve means around the center of rotation of relative rotation with a cylinder block, a cam plate, and a valve means, and it has the rotation operation means for the above-mentioned cam plate, a flow rate or a rotational frequency is correctly [easily and] controllable by rotating the above-mentioned cam plate and adjusting the hoop-direction angular position.

[0047] Especially, according to this invention, the amount of fluid circulation is precisely [smoothly and] controllable near the amount of maximum-flow object circulation.

[0048] Moreover, according to this invention, by attaching a cam plate in the axis of rotation possible [rotation], it is not necessary to establish a special rotation shaft, and there are few necessary members, it ends, a mechanism is easy, and a miniaturization is easy.

[Translation done.]

* NOTICES *

TECHNICAL FIELD

[Industrial Application] this invention relates to the cam plate type axial piston pump and swash-plate-type piston motor which used the cam plate as a cam member. Especially this invention relates to the piston motor in which the cam plate type axial piston pump and revolving speed control in which control of flow is possible are possible.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

EFFECT OF THE INVENTION

[Effect of the Invention] As mentioned above, since according to the cam plate type axial piston pump and swash-plate-type piston motor of this invention it attached so that the above-mentioned cam plate could be relatively rotated to the above-mentioned valve means around the center of rotation of relative rotation with a cylinder block, a cam plate, and a valve means, and it has the rotation operation means for the above-mentioned cam plate, a flow rate or a rotational frequency is correctly [easily and] controllable by rotating the above-mentioned cam plate and adjusting the hoop-direction angular position.
[0047] Especially, according to this invention, the amount of fluid circulation is precisely [smoothly and] controllable near the amount of maximum-flow object circulation.
[0048] Moreover, according to this invention, by attaching a cam plate in the axis of rotation possible [rotation], it is not necessary to establish a special rotation shaft, and there are few necessary members, it ends, a mechanism is easy, and a miniaturization is easy.

[Translation done.]

* NOTICES *

TECHNICAL PROBLEM

[Description of the Prior Art] In a cam plate type axial piston pump, the cylinder block and the cam plate have been arranged possible [relative rotation] about a center-of-rotation shaft, the cam side which inclined to the cam plate to the field which intersects perpendicularly with the above-mentioned relative axis of rotation was formed, both-way movement of the piston which was held in the cylinder in a cylinder block by the above-mentioned relative rotation, and was energized to the swash-plate-cam side was carried out within the cylinder, and the pump action is realized.
[0003] Control of flow can be performed by changing the degree of angle of inclination of the cam plate to the above-mentioned relative axis of rotation. However, in order to change the angle of this cam plate itself, it is required to support this cam plate free [rotation] around the rotation shaft which intersects perpendicularly for example, with the above-mentioned relative axis of rotation, and it needs the special rotation shaft for it.
[0004] Therefore, the cam plate type axial piston pump of the method which the degree of angle of inclination of a cam plate is changed, and performs control of flow had become the obstacle of a miniaturization while the mechanism became complicated.
[0005] Not only the above-mentioned cam plate type axial piston pump but in case the above problems control a rotational frequency in a swash-plate-type piston motor with the same basic composition, they exist similarly.
[0006] Then, this invention aims at offering the cam plate type axial piston pump which can realize control of flow and revolving speed control by the easy mechanism, and a swash-plate-type piston motor.
[0007] Furthermore, control of flow and revolving speed control are possible, and this invention aims at a miniaturization offering an easy cam plate type axial piston pump and a swash-plate-type piston motor.

[0008] Furthermore, this invention aims at offering the cam plate type axial piston pump and swash-plate-type piston motor which can perform control of flow and revolving speed control smoothly and precisely.

[Translation done.]

* NOTICES *

MEANS

[Means for Solving the Problem] According to this invention, two or more cylinders are formed in the cylinder block as what attains the above-mentioned purpose. The piston is held in each interior of this cylinder, and it has the cam plate made to rotate relatively to the aforementioned cylinder block, and a valve means. The cam side of the aforementioned cam plate is formed so that the distance between the portions and these cylinders corresponding to each aforementioned cylinder may change about the shaft orientations of this cylinder in the case of the aforementioned relative rotation. [in the aforementioned cylinder block], in the circumference of the center of rotation of the aforementioned relative rotation, two or more aforementioned cylinders turn to the direction of this center of rotation, and are arranged. It has an energization means to energize each aforementioned piston to the direction of the cam side of the aforementioned cam plate. The fluid inhalation path and the fluid regurgitation path are formed in the aforementioned valve means, and this fluid inhalation path and the fluid regurgitation path are arranged so that each aforementioned cylinder may be made open for free passage the aforementioned fluid inhalation path and a fluid regurgitation path, and by turns on the occasion of the aforementioned relative rotation. The aforementioned cam plate is attached so that it can rotate relatively to the aforementioned valve means around the center of rotation of the aforementioned relative rotation, and cam-plate-type-axial-piston-pump ** characterized by what it has a rotation operation means to operate rotation of this cam plate for is offered.
[0010] According to one mode of this invention, it has the axis of rotation in alignment with the center of rotation of the aforementioned relative rotation, to the aforementioned valve means and the aforementioned cam plate, this axis of rotation is attached so that relative rotation may be possible, and the aforementioned cylinder block is attached in the aforementioned axis of rotation, and let the aforementioned cam plate be a relative rotatable to the aforementioned axis of rotation. According to one mode of this invention, the aforementioned energization means is a compression spring arranged in each aforementioned cylinder.

* NOTICES *

EXAMPLE

[Example] Hereafter, the concrete example of this invention is explained, referring to a drawing.
[0018] Drawing 1 is the decomposition perspective diagram showing the 1st example of the cam plate type axial piston pump by this invention, and drawing 2 , drawing 3 , and drawing 4 are the cross sections of the assembly state.
[0019] In these drawings, 2 is the casing fuselage section, 4 and 6 are the casing lid sections, it is combined with a bolt, it is unified and these constitute casing. In casing, the cavity of the shape of a cylindrical shape of the symmetry of revolution centering on the direction of X-Y is formed. In this cavity, the axis of rotation 8 of the direction of X-Y is arranged. This axis of rotation 8 is supported so that it can rotate by the casing lid sections 4 and 6 through bearing, and the edge by the side of the direction of X has extended out of casing. This axis of rotation 8 has spline 8A in the portion in casing. In addition, in the following explanation, unless shaft orientations, the direction of a path, and a hoop direction have directions especially, all shall point out the direction about the axis of rotation 8.
[0020] In the above-mentioned casing cavity, the cylinder block 10 of an annulus ring configuration is arranged. This cylinder block 10 has spline 8A of the above-mentioned axis of rotation 8, and ******** spline hole 10A in the center section. Seven cylinders 12 are formed in the cylinder block 10 in parallel along the direction of the center of rotation of the axis of rotation 8. These cylinders are equally arranged about the hoop direction of the axis of rotation 8. Opening of these cylinders 12 is carried out in the end face by the side of the direction of X of a cylinder block 10, respectively. moreover -- the end face by the side of the direction of Y of a cylinder block 10 -- each cylinder 12 and free passage **** fluid circulation -- the hole 14 is formed The piston 16 is held in each cylinder 12. Each piston 16 is energized in the direction of X by the compression spring 18 held in the cylinder 12. The spherical-surface seat is formed in the end face by the side of the direction of X of a piston 16, and it holds in this spherical-surface seat so that sliding rotation of sphere 20 may be possible. Penetration formation of the fluid circulation stoma 22 of shaft orientations is carried out through the pars basilaris ossis occipitalis of the above-mentioned spherical-surface seat at the piston 16.
[0021] The casing lid section 6 also has a function as a valve means. Namely, the portion by the side of the direction of X of the casing lid section 6 is formed as valve Itabe material 26. The field by the side of the direction of X of this valve Itabe material 26 is made into the sliding contact surface with the end face by the side of the direction of Y of a cylinder block 10. here -- the above-mentioned fluid circulation -- the fluid inhalation opening 28 and the fluid regurgitation opening 30 which were formed in the hoop direction in the shape of a slot over about a semicircle in the direction position of a path corresponding to a hole 14, respectively are prepared These fluid inhalation opening 28 and the fluid regurgitation opening 30 form the fluid inhalation path and the fluid regurgitation path. The fluid suction pipe 32 and the fluid discharge tube 34 are combined with the casing lid section 6, and these fluid suction pipe 32 and the fluid discharge tube 34 are open for free passage with the above-mentioned fluid inhalation opening 28 and the fluid regurgitation opening 30, respectively. therefore -- if a cylinder block 10 rotates around the axis of rotation 8 -- each cylinder 12 and free passage **** fluid circulation -- a hole 14 runs by maintaining a free passage state by turns one by one to the above-mentioned fluid

inhalation opening 28 and the fluid regurgitation opening 30 In the direction position of a path equivalent to the above-mentioned fluid inhalation opening 28 and the fluid regurgitation opening 30, pinholes 36 and 38 are formed among these openings, and the distribution channel currently formed in these pinholes by standing in a row is prolonged to the bearing section for support of the axis of rotation 8.

[0022] In the casing cavity, the strange cam plate (cam member) 42 with the good degree of angle of inclination is arranged. This cam plate 42 is supported so that it can rotate by the axis of rotation 8 through bearing. The field by the side of the direction of Y is set to cam side 42A, and, as for the cam plate 42, the worm gearing 44 is formed in the peripheral face more than over the semicircle at the hoop direction. This worm gearing has geared with the worm 46, and this worm is attached in the rotation operating member 48 inserted by penetrating the casing fuselage section 2 from the outside of casing. This rotation operating member 48 can rotate a cam plate 42 around the axis of rotation 8 by being supported so that it can rotate to the casing fuselage section 2, therefore rotating it.

[0023] in addition, the sphere held in the spherical-surface seat of the piston 22 energized by above-mentioned swash-plate-cam side 42A in the direction of X by the above-mentioned compression spring 18 -- 20 rolls and it is made to contact so that it may be possible

[0024] In the axis of rotation 8 and a cylinder block 10, the clockwise rotation in drawing 4 carries out drive rotation (however, the cylinder block 10 has not appeared in drawing 4). M1 each cylinder 12 is indicated to be in drawing 4 when it is in hoop-direction angle within the limits, a piston 16 and sphere 20 push in the direction of X according to the extension force of the coil spring 18 in a cylinder 12 -- having -- a sphere -- a piston 16 and sphere 20 move in the direction of X, maintaining the contact state of 20 and swash-plate-cam side 42A and one of the cylinders 12 -- fluid circulation -- while it is open for free passage with the fluid inhalation opening 28 through a hole 14, a fluid (for example, oil) is inhaled into a cylinder 12 through the fluid inhalation opening 28 from the fluid suction pipe 32 (namely, when it is in angle within the limits of N1 shown in drawing 4) M2 [moreover,] each cylinder 12 is indicated to be in drawing 4 the time of being in hoop-direction angle within the limits -- a sphere -- while maintaining the contact state of 20 and swash-plate-cam side 42A -- swash-plate-cam side 42A -- a sphere -- 20 and a piston 16 resist the extension force of the coil spring 18 in a cylinder 12, are pushed in the direction of Y, and move and one of the cylinders 12 -- fluid circulation -- while it is open for free passage with the fluid regurgitation opening 30 through a hole 14, a fluid is breathed out through the fluid regurgitation opening 30 to the fluid discharge tube 34 (namely, when it is in angle within the limits of N2 shown in drawing 4) Suppose that it is the time of a cam plate 42 being in such a hoop-direction angle-of-rotation position hoop-direction angle-of-rotation =0 degree of a cam plate 42.

[0025] That is, it is M1 bordering on m. In a side, a fluid is inhaled from the fluid inhalation opening 28 to a cylinder 12, and it is M2. In a side, a fluid is breathed out from a cylinder 12 to the fluid **** opening 30. This m is made the dead point boundary angular position.

[0026] Drawing 5 is explanatory drawing showing the change of pump operation at the time of changing the hoop-direction angle of rotation theta of a cam plate 42. Drawing 5 (a) is drawing showing how to take the hoop-direction angle of rotation theta of a cam plate 42, and makes the angle at the time of making it rotate to the circumference of the half clock in drawing 3 the hoop-direction angle of rotation theta by operation using the rotation operating member 48 from the state of the 0 degree of the above-mentioned hoop-direction angle of rotation. The distance between swash-plate-cam side 42A in the hoop-direction angular position of a cylinder 12 changes gradually with the increase in the hoop-direction angle of rotation theta. For this reason, the above-mentioned dead point boundary angular position m becomes a clockwise rotation in drawing 4 with the position of which angle theta rotation was done.

[0027] For example, when fluid **** is made from a cylinder 12 when an angle theta is 45 degrees, the dead point boundary angular position becomes like m', therefore each cylinder 12 is in the position of the direction of a counterclockwise rotation from m' in drawing 4 to the fluid inhalation opening 28, and each cylinder 12 is in the position of the direction of a clockwise rotation in drawing 4 from m', fluid inhalation is made to a cylinder 12. Therefore, the fluid of the amount equivalent to the difference of the

amount of fluid inhalation from the fluid inhalation opening 28 to a cylinder 12 and the fluid discharge quantity from the cylinder 12 to the fluid inhalation opening 28 will be inhaled from the fluid suction pipe 32 to the fluid inhalation opening 28. When similarly fluid inhalation is made to a cylinder 12 when each cylinder 12 is in the position of the direction of a counterclockwise rotation from m' in drawing 4 to the fluid **** opening 30, and each cylinder 12 is in the position of the direction of a clockwise rotation in drawing 4 from m', fluid **** is made from a cylinder 12. Therefore, the fluid of the amount equivalent to the difference of the fluid discharge quantity from the cylinder 12 to the fluid **** opening 30 and the amount of fluid inhalation from the fluid **** opening 30 to a cylinder 12 will be breathed out from the fluid discharge tube 34 to the fluid **** opening 30.

[0028] Since the amount of fluid inhalation from the fluid inhalation opening 28 to a cylinder 12 and the fluid discharge quantity from the cylinder 12 to the fluid inhalation opening 28 become equal in this way when an angle theta is 90 degrees, the fluid inflow to the fluid inhalation opening 28 from the fluid suction pipe 32 is lost. Since the amount of fluid inhalation from the fluid regurgitation opening 30 to a cylinder 12 and the fluid discharge quantity from the cylinder 12 to the fluid regurgitation opening 30 become equal, the fluid regurgitation from the fluid regurgitation opening 30 to the fluid discharge tube 34 is also lost.

[0029] An operation with the fluid suction pipe 32 and the fluid discharge tube 34 reverses [an angle theta] before 180 degrees exceeding 90 degrees, a fluid is breathed out to the fluid suction pipe 32, and a fluid is inhaled from the fluid discharge tube 34.

[0030] Drawing 5 (b) shows the outline of the relation between an angle theta and the amount of fluid circulation. Curve C1 The amount of fluid inhalation from the fluid suction pipe 32 is shown (+ shows inhalation and - shows the regurgitation), and it is a curve C2. The fluid discharge quantity to the fluid discharge tube 34 is shown (- shows the regurgitation and + shows an inflow).

[0031] In addition, by explanation of the more than related with drawing 5 , infinitely, a near number of cylinders 12 made the model in the hoop direction per gestalt of the limit infinitely arranged at the small interval, and explained to it.

[0032] In this example, since a fluid is supplied into a spherical-surface seat through the circulation stoma 22, the lubrication action between sphere 20 is performed good as this spherical-surface seat. Moreover, the hoop-direction angle range in which each cylinder 12 stops opening any of the fluid inhalation opening 28 and the fluid regurgitation opening 30 for free passage existed, and although there is discontinuous fear of operation by the fluid regurgitation from a cylinder 12 being blocked especially in these angle ranges, the discharge-flow object from a cylinder 12 is received in above-mentioned angle within the limits by forming pinholes 36 and 38 in the above-mentioned example. Thereby, the lubrication of bearing is also realizable while being able to make pump operation perform continuously and smoothly.

[0033] As mentioned above, in this example, to the axis of rotation 8 of a cylinder block's 10 rotation sake, it can attach so that rotation and rotation of a cam plate 42 may be possible, and the amount of fluid circulation (discharge quantity) can be controlled by setting up suitably the surrounding hoop-direction rotation position of the axis of rotation 8 of this cam plate easily and correctly. Especially, in this example, since the change of the amount of circulation to an angle of rotation theta is small in theta= 0-degree near, there is the special feature that the amount of circulation is precisely [smoothly and] controllable near the amount of the maximum circulation. Moreover, in this example, since the cam plate 42 is attached in the axis of rotation 8 possible [rotation], it is not necessary to establish a special rotation shaft, and there are few necessary members, it ends, a mechanism is easy, and a miniaturization is easy.

[0034] moreover -- above -- this example -- setting -- between each piston 16 and swash-plate-cam side 42A -- a sphere, since 20 is arranged Even if the direction of the force which sphere 20 receives from cam side 42A differs from the direction of a cylinder 12 and a piston 16 strictly Since only the force of the direction of a cylinder 12 and a piston 16 is applied to the piston 16 which is carrying out field contact with the cylinder 12 from sphere 20 As for this thing, a parenchyma top does not have a lateral pressure to a cylinder 12 as the length of a piston 16 is short. Therefore, that it is hard to generate the

fluid leakage by which wear of a cylinder and a piston passes along between a cylinder-piston few, pump efficiency is maintained highly, and has little oscillating generating, and the operation effect that it can moreover miniaturize is acquired.

[0035] Drawing 6 and drawing 7 are the decomposition perspective diagrams showing the 2nd example of the cam plate type axial piston pump by this invention, and drawing 8 , drawing 9 , and drawing 10 are the cross sections of the assembly state. In these drawings, the same sign is given to the member which has the same function also in above-mentioned drawing 1 - drawing 5 . In addition, drawing 7 constitutes a part of drawing 6 (P-Q portion).

[0036] In this example, it sets in a casing cavity, and is the 1st pump section S1 by the side of the direction of X. The 2nd pump section S2 by the side of the direction of Y Two functional divisions are arranged. The 1st pump section S1 It has the same composition as the functional division of the 1st example of the above. Moreover, the 2nd pump section S2 The point that the cam plate is being fixed to casing is removed, and it is the 1st pump section S1. It has the same composition. namely, the 2nd pump section S2 the cylinder block 11 which can be set, spline hole 11A, a cylinder 13, and fluid circulation -- a hole 15, a piston 17, a compression spring 19, and a sphere -- 21, a cam plate 43, and cam side 43A -- respectively -- the 1st pump section S1 the cylinder block 10 which can be set, spline hole 10A, a cylinder 12, and fluid circulation -- a hole 14, a piston 16, a compression spring 18, and a However, the 2nd pump section S2 The cam plate 43 is being fixed to the casing lid section 6.

[0037] And the 1st pump section S1 The 2nd pump section S2 The valve Itabe material 27 currently shared in the two pump sections is fixed and arranged to the casing fuselage section 2 at the boundary section. this ports plate -- let the field by the side of the direction of X of a member 27, and the field by the side of the direction of Y be an end face by the side of the direction of Y of a cylinder block 10, and the sliding contact surface with the end face by the side of the direction of X of a cylinder block 11, respectively -- having -- **** -- here -- the above-mentioned fluid circulation -- the fluid inhalation opening 28 and the fluid regurgitation opening 30 which were formed in the hoop direction in the shape of a slot over about a semicircle in the direction position of a path corresponding to These fluid inhalation opening 28 and the fluid regurgitation opening 30 are penetrated in the XY direction. And the casing fuselage section 2 and the valve Itabe material 27 are penetrated in the AB direction, and the fluid suction pipe 32 and the fluid discharge tube 34 are connected to these inhalation opening and regurgitation opening, respectively. In the direction position of a path equivalent to the above-mentioned fluid inhalation opening 28 and the fluid regurgitation opening 30, pinholes 36 and 38 are formed among these openings, and the distribution channel currently formed in these pinholes by standing in a row is prolonged to opening of the penetration **** XY direction of the axis of rotation 8.

[0038] The axis of rotation 8 is the 1st pump section S1. The 2nd pump section S2 It is used in common, and the above-mentioned cylinder blocks 10 and 11 are attached in the axis of rotation 8 so that the cylinders 12 and 13 of five each which was formed in cylinder blocks 10 and 11 may be located corresponding to the XY direction. Therefore, the corresponding cylinders 12 and 13 are simultaneously open for free passage with the fluid inhalation opening 28 and the fluid **** opening 30 with rotation of the axis of rotation 8.

[0039] The 1st pump section S1 As how to take the hoop-direction angle of rotation theta of a cam plate 42, it is the 2nd pump section S2 as cam side 42A is shown in drawing 8 . When the time of being in cam side 43A of the fixed cam plate 43 and symmetrical arrangement is made into 0 degree, the relation between change of the hoop-direction angle of rotation theta and change of pump operation comes to be shown in drawing 11 . Curve C1 The amount of fluid inhalation from the fluid suction pipe 32 is shown (+ shows inhalation and - shows ****), and it is a curve C2. The fluid discharge quantity to the fluid discharge tube 34 is shown (- shows **** and + shows an inflow). When an angle theta becomes 180 degrees, it is the 1st pump section S1. Swash-plate-cam side 42A and the 2nd pump section S2 Even if an interval with swash-plate-cam side 43A becomes fixed in all hoop-direction angles, therefore the axis of rotation 8 and a cylinder block rotate Since the interval of the corresponding pistons 16 and 17 will not change, fluid **** to the fluid inhalation and the fluid **** opening 30 from cylinders 12 and 13 from the fluid inhalation opening 28 to cylinders 12 and 13 is lost. The fluid inflow to the fluid

inhalation opening 28 from the fluid suction pipe 32 and fluid **** from the fluid **** opening 30 to the fluid discharge tube 34 are lost.
[0040] In addition, by drawing 11 , infinitely, a near number of cylinders 12 made the model in the hoop direction per form of the limit infinitely arranged at the small interval, and explained to it.
[0041] Also in this example, the same operation effect as the 1st example of the above is attained. A fluid can be inhaled from the fluid suction pipe 32, and a fluid can be made to breathe out from the fluid discharge tube 34 in this example in the range whose angle theta is 0 degree - 180 degrees. Moreover, in the case of this example, the flow rate of the double precision of the 1st example of the above is obtained. In addition, it sets in the example of **** 2 and is the above-mentioned 2nd pump section S2. It is the 1st pump section S1 about a cam plate 43. It can also consider as what can rotate like a cam plate 42.
[0042] Drawing 12 and drawing 13 are the decomposition perspective diagrams showing the 3rd example of the cam plate type axial piston pump by this invention, and drawing 14 and drawing 15 are the cross sections of the assembly state. In these drawings, the same sign is given to the same member also in above-mentioned drawing 1 - drawing 11 . In addition, drawing 13 constitutes a part of drawing 12 (P-Q portion).
[0043] In this example, the valve Itabe material 27 used in the 2nd example of the above is removed, and the common unification of the compression spring in the cylinder corresponding to [in this cylinder block] two cylinder block rows and this cylinder is carried out instead of. That is, the 1st and 2nd pistons 16 and 17 were held in each one cylinder 12 of a cylinder block 10, and one compression spring 18 is arranged to the field in a cylinder between the pistons which these-correspond. and the shaft-orientations position corresponding to [form in the inside of the casing fuselage section 2 the fluid inhalation slot 29 and fluid ****** 31 as a substitute of fluid inhalation opening used in the 2nd example of the above, and fluid **** opening over about a semicircle at a hoop direction, respectively, and] these -- setting -- a cylinder block 10 -- the 1st of each cylinder and the 2nd piston 16, the field between 17, and free passage **** fluid circulation -- the hole 15 is formed And the casing fuselage section 2 is penetrated to the above-mentioned fluid inhalation slot 29 and fluid ****** 31, and the fluid suction pipe 32 and the fluid discharge tube 34 are connected to them, respectively.
[0044] Also in this example, the same operation effect as the 2nd example of the above is attained. Furthermore, at this example, since a ports-plate member is omitted and the valve means is formed in the casing fuselage section 2, there are few part mark.
[0045] As mentioned above, although the example of the piston pump which carries out drive rotation of the axis of rotation 8, inhales a fluid from the fluid suction pipe 32, and carries out the regurgitation of the fluid from the fluid discharge tube 34 was explained, the piston motor made to rotate the axis of rotation 8 as an output shaft can be constituted by removing the energization means slack compression spring for the piston energization in these piston pumps, and introducing a high-pressure fluid from either the fluid suction pipe 32 or the fluid discharge tubes 34, and discharging a fluid from another side. In such a piston motor, the same operation effect as what transposed the control of flow in the operation effect explained per each example of the above-mentioned piston pump to revolving speed control is acquired.

[Translation done.]

* NOTICES *

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the decomposition perspective diagram showing the 1st example of the cam plate type axial piston pump by this invention.
[Drawing 2] It is the cross section of the assembly state of the 1st example of the cam plate type axial piston pump by this invention.
[Drawing 3] It is the cross section of the assembly state of the 1st example of the cam plate type axial piston pump by this invention.
[Drawing 4] It is the cross section of the assembly state of the 1st example of the cam plate type axial piston pump by this invention.
[Drawing 5] It is explanatory drawing showing change of pump operation at the time of changing hoop-direction angle of rotation of a cam plate in the 1st example of the cam plate type axial piston pump by this invention.
[Drawing 6] It is the decomposition perspective diagram showing the 2nd example of the cam plate type axial piston pump by this invention.
[Drawing 7] It is the decomposition perspective diagram showing the 2nd example of the cam plate type axial piston pump by this invention.
[Drawing 8] It is the cross section of the assembly state of the 2nd example of the cam plate type axial piston pump by this invention.
[Drawing 9] It is the cross section of the assembly state of the 2nd example of the cam plate type axial piston pump by this invention.
[Drawing 10] It is the cross section of the assembly state of the 2nd example of the cam plate type axial piston pump by this invention.
[Drawing 11] It is explanatory drawing showing change of pump operation at the time of changing hoop-direction angle of rotation of a cam plate in the 2nd example of the cam plate type axial piston pump by this invention.
[Drawing 12] It is the decomposition perspective diagram showing the 3rd example of the cam plate type axial piston pump by this invention.
[Drawing 13] It is the decomposition perspective diagram showing the 3rd example of the cam plate type axial piston pump by this invention.
[Drawing 14] It is the cross section of the assembly state of the 3rd example of the cam plate type axial piston pump by this invention.
[Drawing 15] It is the cross section of the assembly state of the 3rd example of the cam plate type axial piston pump by this invention.
[Description of Notations]
2 Casing Fuselage Section
4 Six Casing lid section
8 Axis of Rotation
8A Spline

10 11 Cylinder block
10A, 11A Spline hole
12 13 Cylinder
14 15 Fluid style through-hole
16 17 Piston
18 19 Compression spring
20 21 Sphere
22 Fluid Circulation Stoma
26 27 Valve Itabe material
28 Fluid Inhalation Opening
29 Fluid Inhalation Slot
30 Fluid Regurgitation Opening
31 Fluid Regurgitation Slot
32 Fluid Suction Pipe
34 Fluid Discharge Tube
42 43 Cam plate
42A, 43A Swash-plate-cam side
44 Worm Gearing
46 Worm
48 Rotation Operating Member
S1 The 1st pump section
S2 The 2nd pump section

[Translation done.]

* NOTICES *

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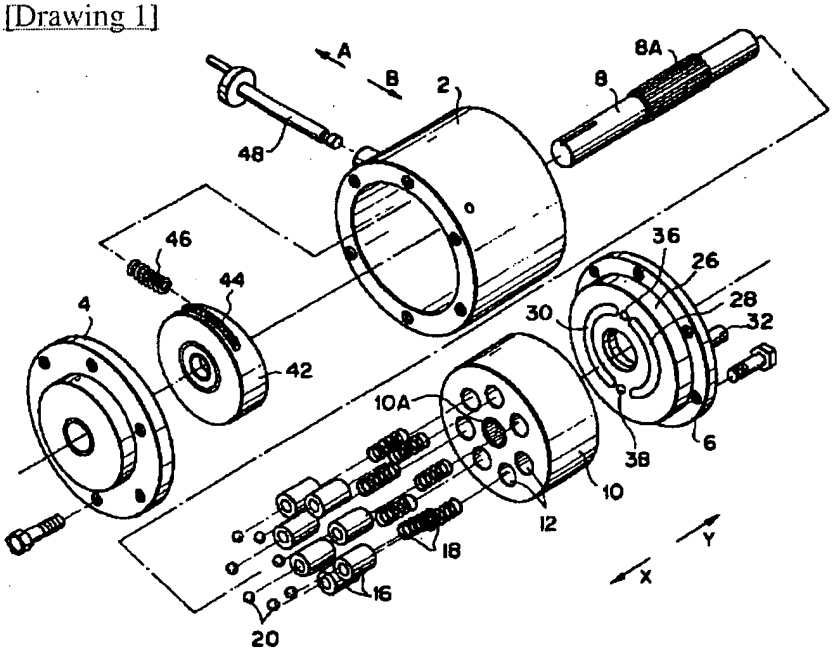
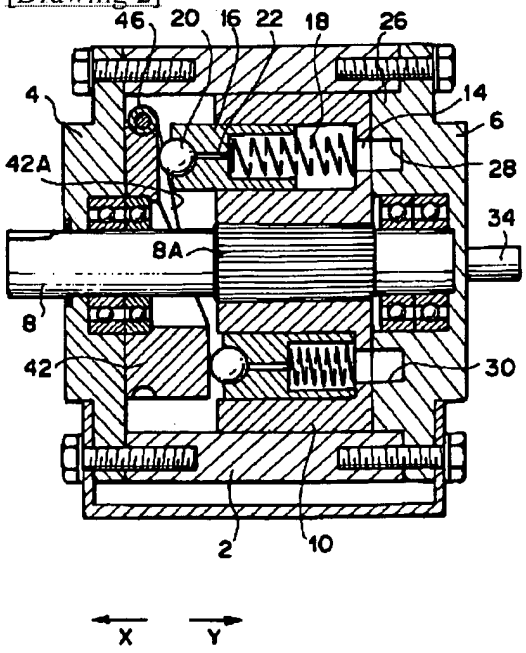
DRAWINGS

[Drawing 1]



[Drawing 2]



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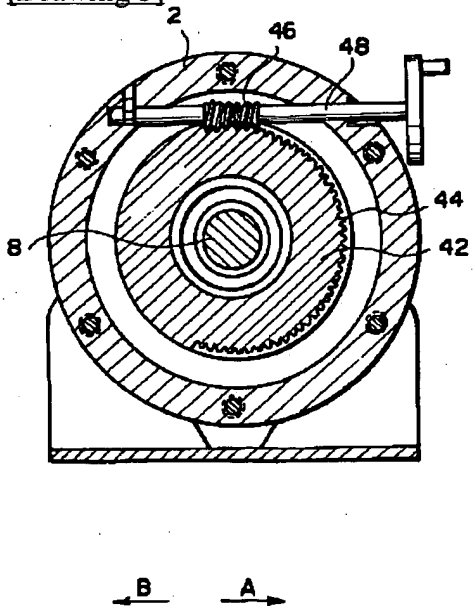

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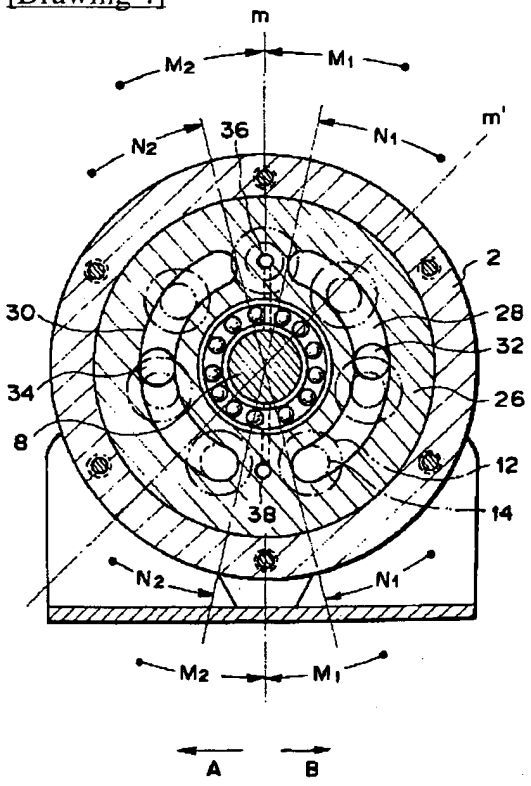
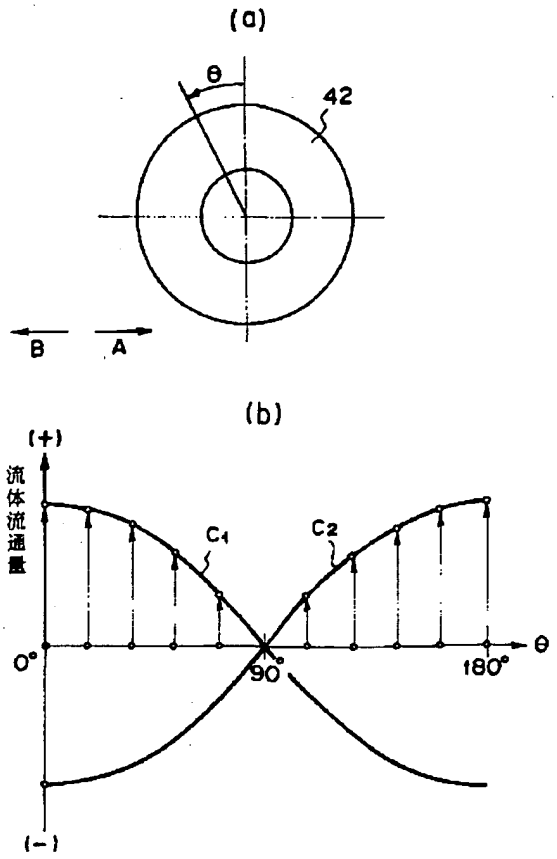
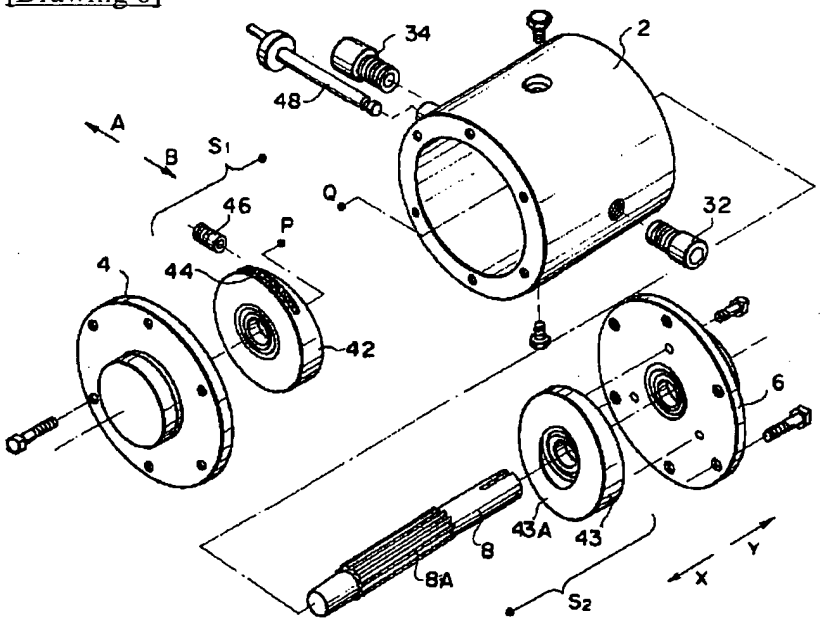


[Drawing 5]



[Drawing 6]



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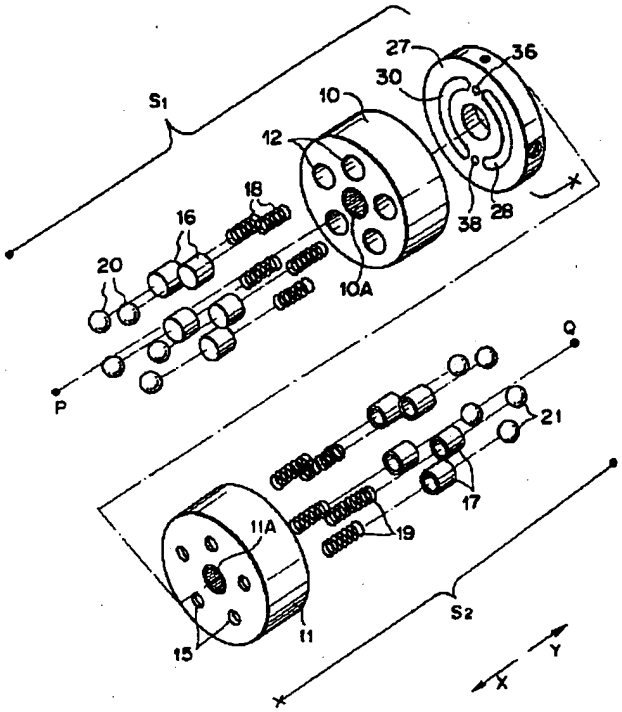
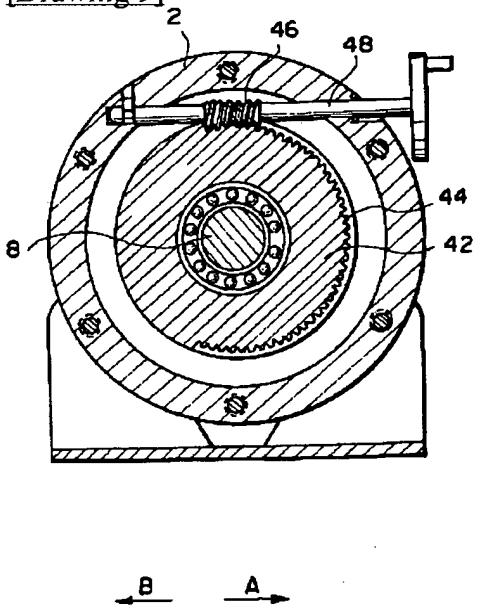
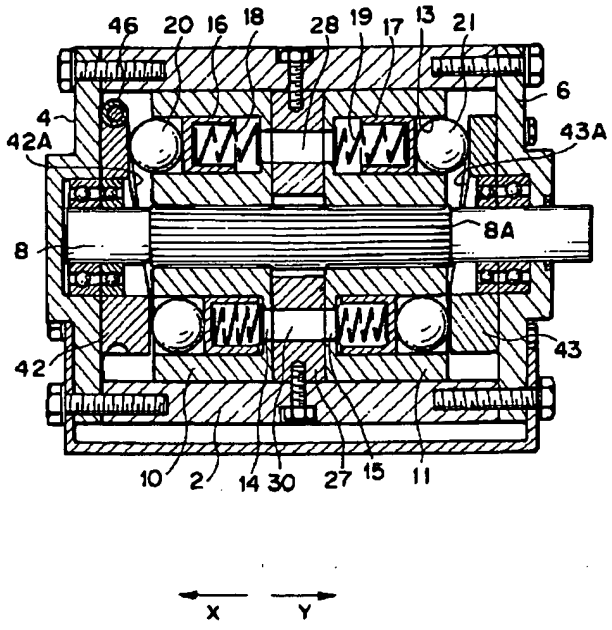


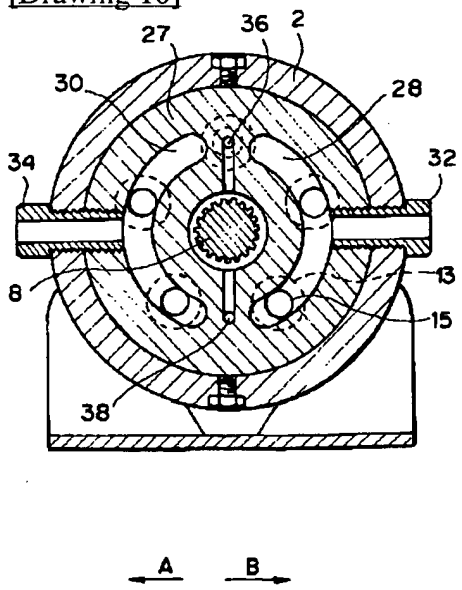
[Drawing 9]



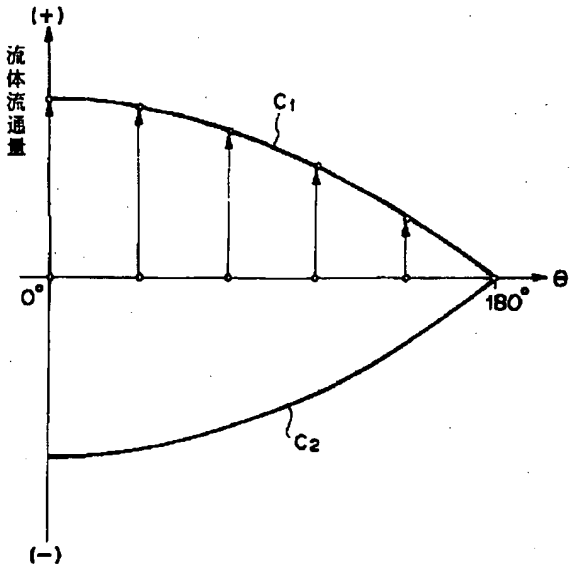
[Drawing 8]



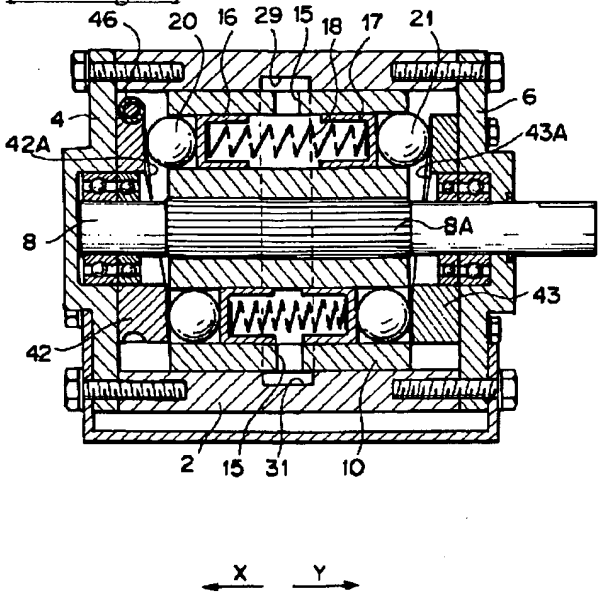
[Drawing 10]



[Drawing 11]



[Drawing 14]



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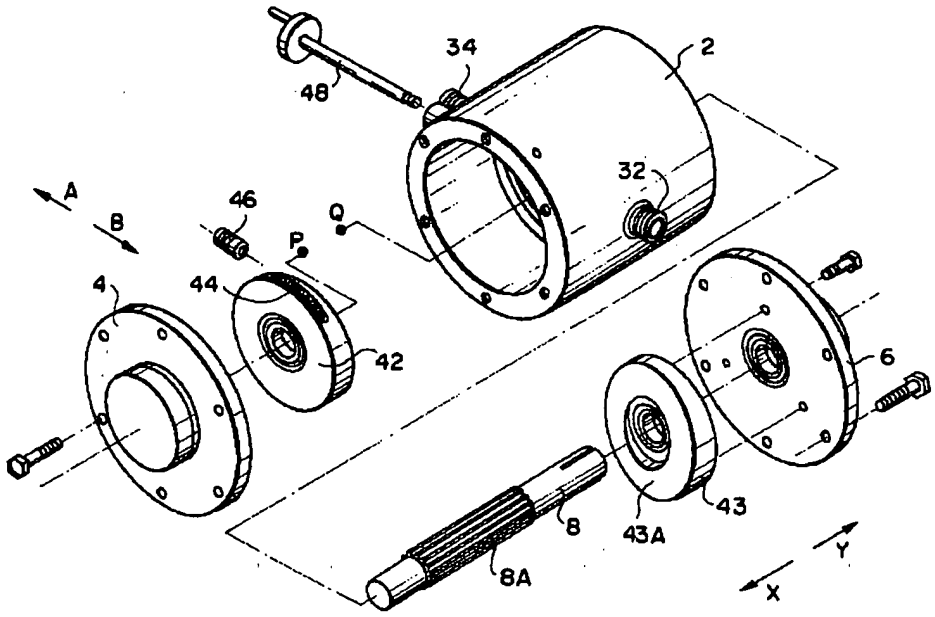
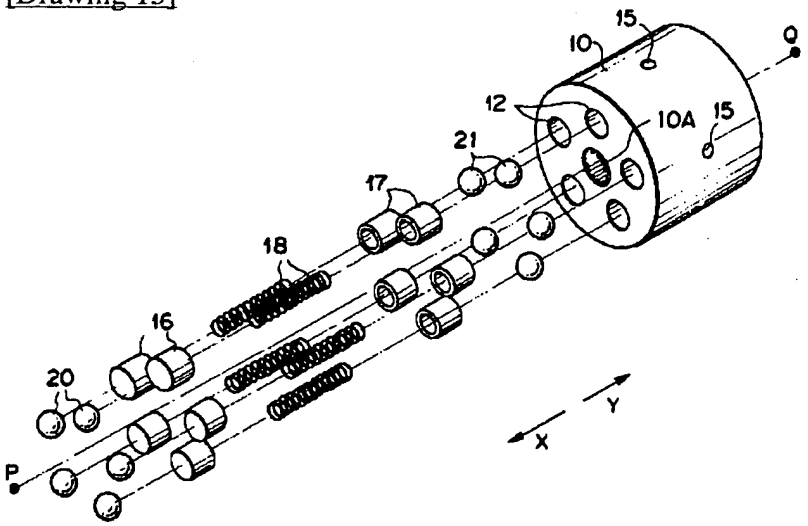
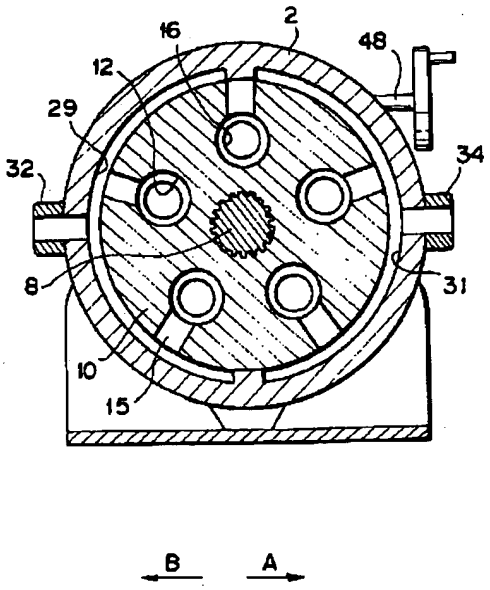


[Drawing 13]



[Drawing 15]



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Ｆ０３Ｃ　1/06			Ｆ０３Ｃ　1/06		
Ｆ０４Ｂ　9/02			Ｆ０４Ｂ　9/02	Ｃ	

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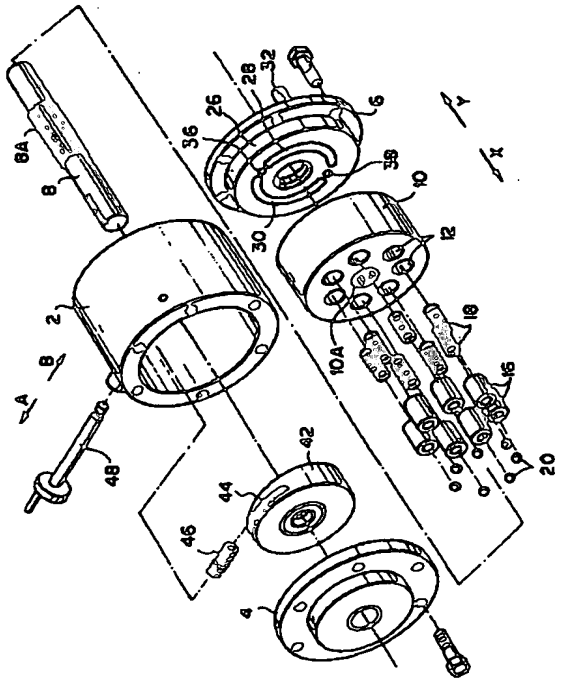
(54)【発明の名称】　斜板式ピストンポンプ及び斜板式ピストンモータ

(57)【要約】
【目的】　簡単な機構で、小型化が容易で、滑らか且つ精密に流量制御を行い得る斜板式ピストンポンプを提供する。
【構成】　回転軸８に取付けられたシリンダブロック１０内に複数のシリンダ１２が形成されており、各シリンダ１２の内部にはピストン１６が収容されている。回転軸８は弁板部材２６及び斜板４２に対し相対回転され、この相対回転の際に斜板４２のカム面は各シリンダ１２に対応する部分とシリンダ１２との間の距離がシリンダの軸方向に関し変化する。各ピストン１６は圧縮コイルバネ１８により斜板４２の方へと付勢されている。弁板部材２６には流体吸入開口２８及び流体吐出開口３０が形成されており、各シリンダ１２が流体吸入開口２８及び流体吐出開口３０と交互に連通する。斜板４２は、回転軸８に対し相対的に回動可能であり、斜板回動操作部材４８により回動される。



【特許請求の範囲】

【請求項１】　シリンダブロック内に複数のシリンダが形成されており、該シリンダのそれぞれの内部にはピストンが収容されており、前記シリンダブロックに対し相対的に回転せしめられる斜板及び弁手段を有し、前記斜板のカム面は前記相対的回転の際に前記各シリンダに対応する部分と該シリンダとの間の距離が該シリンダの軸方向に関し変化する様に形成されており、前記複数のシリンダは前記シリンダブロック内において前記相対的回転の回転中心の周囲において該回転中心の方向を向いて配置されており、前記各ピストンを前記斜板のカム面の方へと付勢する付勢手段を有し、

前記弁手段には流体吸入経路及び流体吐出経路が形成されており、前記各シリンダが前記相対的回転に際し前記流体吸入経路及び流体吐出経路と交互に連通せしめられる様に該流体吸入経路及び流体吐出経路が配置されており、

前記斜板は前記相対的回転の回転中心の周りで前記弁手段に対し相対的に回動可能な様に取付けられており、該斜板の回動を操作する回動操作手段を有する、ことを特徴とする、斜板式ピストンポンプ。

【請求項２】　前記相対的回転の回転中心に沿った回転軸を有し、該回転軸は前記弁手段及び前記斜板に対し相対回転可能な様に取付けられており、前記シリンダブロックは前記回転軸に取付けられており、前記斜板は前記回転軸に対し相対的回動可能とされていることを特徴とする、請求項１に記載の斜板式ピストンポンプ。

【請求項３】　前記回動操作手段は前記斜板の外周部に形成されたウォームギヤと噛み合うウォームを備えているものであることを特徴とする、請求項１または２に記載の斜板式ピストンポンプ。

【請求項４】　前記各ピストンと前記斜板のカム面との間にはこれらに対し転がり又は摺動回転可能な球形状の媒介部材が介在していることを特徴とする、請求項１～３のいずれかに記載の斜板式ピストンポンプ。

【請求項５】　前記付勢手段は前記各シリンダ内に配置された圧縮バネであることを特徴とする、請求項１～４のいずれかに記載の斜板式ピストンポンプ。

【請求項６】　第１ポンプ部と第２ポンプ部とを有し、これら第１ポンプ部及び第２ポンプ部の各々において、シリンダブロック内に複数のシリンダが形成されており、該シリンダのそれぞれの内部にはピストンが収容されており、前記シリンダブロックに対し相対的に回転せしめられる斜板及び弁手段を有し、前記斜板のカム面は前記相対的回転の際に前記各シリンダに対応する部分と該シリンダとの間の距離が該シリンダの軸方向に関し変化する様に形成されており、前記複数のシリンダは前記シリンダブロック内において前記相対的回転の回転中心の周囲において該回転中心の方向を向いて配置されており、前記各ピストンを前記斜板のカム面の方へと付勢する付勢手段を有し、

前記第１ポンプ部及び第２ポンプ部の前記相対的回転の回転中心は合致しており、該回転中心に沿い前記第１ポンプ部及び第２ポンプ部に共用される回転軸を有し、

前記第１ポンプ部の弁手段及び前記第２ポンプ部の弁手段は共用されていて流体吸入経路及び流体吐出経路が形成されており、前記第１ポンプ部及び第２ポンプ部の各シリンダが前記相対的回転に際し前記流体吸入経路及び流体吐出経路と交互に連通せしめられる様に該流体吸入経路及び流体吐出経路が配置されており、

前記第１ポンプ部の斜板及び前記第２ポンプ部の斜板のうちの少なくとも一方は前記相対的回転の回転中心の周りで前記弁手段に対し相対的に回動可能な様に取付けられており、該斜板の回動を操作する回動操作手段を有し、

前記回転軸は前記弁手段及び前記第１ポンプ部の斜板及び前記第２ポンプ部の斜板に対し相対回転可能な様に取付けられており、前記第１ポンプ部のシリンダブロック及び前記第２ポンプ部のシリンダブロックは前記回転軸に取付けられており、前記相対的回転の回転中心の周りで前記弁手段に対し相対的に回動可能な様に取付けられた斜板は前記回転軸に対し相対的回動可能とされている、ことを特徴とする、斜板式ピストンポンプ。

【請求項７】　前記回動操作手段は前記斜板の外周部に形成されたウォームギヤと噛み合うウォームを備えているものであることを特徴とする、請求項６に記載の斜板式ピストンポンプ。

【請求項８】　前記各ピストンと前記斜板のカム面との間にはこれらに対し転がり又は摺動回転可能な球形状の媒介部材が介在していることを特徴とする、請求項６または７に記載の斜板式ピストンポンプ。

【請求項９】　前記付勢手段は前記各シリンダ内に配置された圧縮バネであることを特徴とする、請求項６～８のいずれかに記載の斜板式ピストンポンプ。

【請求項１０】　シリンダブロック内に複数のシリンダが形成されており、該シリンダのそれぞれの内部には第１ピストン及び第２ピストンが収容されており、前記シリンダブロックに対し相対的に回転せしめられる第１斜板及び第２斜板が前記シリンダの軸方向に関し前記シリンダブロックの両側に配置されており、前記第１斜板及び第２斜板のカム面はいずれも前記相対的回転の際に前記各シリンダに対応する部分と該シリンダとの間の距離が該シリンダの軸方向に関し変化する様に形成されており、前記複数のシリンダは前記シリンダブロック内において前記相対的回転の回転中心の周囲において該回転中心の方向を向いて配置されており、前記第１ピストン及び第２ピストンをそれぞれ前記第１斜板のカム面及び前記第２手段のカム面の方へと付勢する付勢手段を有し、前記シリンダブロックに対し相対的に回転せしめられる弁手段を有し、該弁手段には流体吸入経路及び流体吐出

経路が形成されており、前記各シリンダの前記第１ピストンと第２ピストンとの間の領域は前記シリンダブロックに形成された流体流通孔を介して前記相対的回転に際し前記流体吸入経路及び流体吐出経路と交互に連通せしめられる様に該流体吸入経路及び流体吐出経路が配置されており、
前記第１斜板及び第２斜板のうちの少なくとも一方は前記相対的回転の回転中心の周りで前記弁手段に対し相対的に回動可能な様に取付けられており、該斜板の回動を操作する回動操作手段を有する、ことを特徴とする、斜板式ピストンポンプ。
【請求項１１】　前記相対的回転の回転中心に沿った回転軸を有し、該回転軸は前記弁手段及び前記第１斜板及び第２斜板に対し相対回転可能な様に取付けられており、前記シリンダブロックは前記回転軸に取付けられており、前記相対的回転の回転中心の周りで前記弁手段に対し相対的に回動可能な様に取付けられた斜板は前記回転軸に対し相対的回動可能とされていることを特徴とする、請求項１０に記載の斜板式ピストンポンプ。
【請求項１２】　前記回動操作手段は前記斜板の外周部に形成されたウォームギヤと噛み合うウォームを備えているものであることを特徴とする、請求項１０または１１に記載の斜板式ピストンポンプ。
【請求項１３】　前記各ピストンと前記斜板のカム面との間にはこれらに対し転がり又は摺動回転可能な球形状の媒介部材が介在していることを特徴とする、請求項１０～１２のいずれかに記載の斜板式ピストンポンプ。
【請求項１４】　前記付勢手段は前記各シリンダ内において前記第１ピストンと第２ピストンとの間に配置された圧縮バネであることを特徴とする、請求項１０～１３のいずれかに記載の斜板式ピストンポンプ。
【請求項１５】　前記請求項１～４，６～８，１０～１３のいずれかに記載の斜板式ピストンポンプの構成のうちの前記付勢手段を除去し且つ前記流体吸入経路及び流体吐出経路のうちの一方を流体供給経路となし他方を流体排出経路となしたことを特徴とする、斜板式ピストンモータ。
【発明の詳細な説明】
【０００１】
【産業上の利用分野】本発明は、カム部材として斜板を用いた斜板式ピストンポンプ及び斜板式ピストンモータに関する。特に、本発明は、流量制御可能な斜板式ピストンポンプ及び回転数制御可能なピストンモータに関する。
【０００２】
【従来の技術及び発明が解決しようとする課題】斜板式ピストンポンプにおいては、シリンダブロックと斜板とを回転中心軸に関して相対回転可能に配置し、斜板に上記相対回転軸と直交する面に対し傾いたカム面を形成しておき、上記相対回転によりシリンダブロック内のシリンダに収容され斜板カム面に対し付勢されたピストンをシリンダ内で往復移動させて、ポンプ作用を実現している。
【０００３】上記相対回転軸に対する斜板の傾き角度を変化させることにより流量制御を行うことができる。しかし、この斜板自体の角度を変化させるには、該斜板を例えば上記相対回転軸と直交する回動軸の周りで回動自在に支持することが必要であり、このための特別の回動軸を必要とする。
【０００４】従って、斜板の傾き角度を変化させて流量制御を行う方式の斜板式ピストンポンプは、機構が複雑になるとともに小型化の障害となっていた。
【０００５】以上の様な問題は、上記斜板式ピストンポンプのみならず、同様の基本構成をもつ斜板式ピストンモータにおいて回転数を制御する際にも同様に存在する。
【０００６】そこで、本発明は、流量制御や回転数制御を簡単な機構で実現できる斜板式ピストンポンプや斜板式ピストンモータを提供することを目的とする。
【０００７】更に、本発明は、流量制御や回転数制御が可能で小型化が容易な斜板式ピストンポンプや斜板式ピストンモータを提供することを目的とする。
【０００８】更に、本発明は、流量制御や回転数制御を滑らか且つ精密に行い得る斜板式ピストンポンプ及び斜板式ピストンモータを提供することを目的とする。
【０００９】
【課題を解決するための手段】本発明によれば、上記目的を達成するものとして、シリンダブロック内に複数のシリンダが形成されており、該シリンダのそれぞれの内部にはピストンが収容されており、前記シリンダブロックに対し相対的に回転せしめられる斜板及び弁手段を有し、前記斜板のカム面は前記相対的回転の際に前記各シリンダに対応する部分と該シリンダとの間の距離が該シリンダの軸方向に関し変化する様に形成されており、前記複数のシリンダは前記シリンダブロック内において前記相対的回転の回転中心の周囲において該回転中心の方向を向いて配置されており、前記各ピストンを前記斜板のカム面の方へと付勢する付勢手段を有し、前記弁手段には流体吸入経路及び流体吐出経路が形成されており、前記各シリンダが前記相対的回転に際し前記流体吸入経路及び流体吐出経路と交互に連通せしめられる様に該流体吸入経路及び流体吐出経路が配置されており、前記斜板は前記相対的回転の回転中心の周りで前記弁手段に対し相対的に回動可能な様に取付けられており、該斜板の回動を操作する回動操作手段を有する、ことを特徴とする、斜板式ピストンポンプ、が提供される。
【００１０】本発明の一態様によれば、前記相対的回転の回転中心に沿った回転軸を有し、該回転軸は前記弁手段及び前記斜板に対し相対回転可能な様に取付けられており、前記シリンダブロックは前記回転軸に取付けられ

ており、前記斜板は前記回転軸に対し相対的回動可能とされている。本発明の一態様によれば、前記付勢手段は前記各シリンダ内に配置された圧縮バネである。

【００１１】また、本発明によれば、上記目的を達成するものとして、第１ポンプ部と第２ポンプ部とを有し、これら第１ポンプ部及び第２ポンプ部の各々において、シリンダブロック内に複数のシリンダが形成されており、該シリンダのそれぞれの内部にはピストンが収容されており、前記シリンダブロックに対し相対的に回転せしめられる斜板及び弁手段を有し、前記斜板のカム面は前記相対的回転の際に前記各シリンダに対応する部分と該シリンダとの間の距離が該シリンダの軸方向に関し変化する様に形成されており、前記複数のシリンダは前記シリンダブロック内において前記相対的回転の回転中心の周囲において該回転中心の方向を向いて配置されており、前記各ピストンを前記斜板のカム面の方へと付勢する付勢手段を有し、前記第１ポンプ部及び第２ポンプ部の前記相対的回転の回転中心は合致しており、該回転中心に沿い前記第１ポンプ部及び第２ポンプ部に共用される回転軸を有し、前記第１ポンプ部の弁手段及び前記第２ポンプ部の弁手段は共用されていて流体吸入経路及び流体吐出経路が形成されており、前記第１ポンプ部及び第２ポンプ部の各シリンダが前記相対的回転に際し前記流体吸入経路及び流体吐出経路と交互に連通せしめられる様に該流体吸入経路及び流体吐出経路が配置されており、前記第１ポンプ部の斜板及び前記第２ポンプ部の斜板のうちの少なくとも一方は前記相対的回転の回転中心の周りで前記弁手段に対し相対的に回動可能な様に取付けられており、該斜板の回動を操作する回動操作手段を有し、前記回転軸は前記弁手段及び前記第１ポンプ部の斜板及び前記第２ポンプ部の斜板に対し相対回転可能な様に取付けられており、前記第１ポンプ部のシリンダブロック及び前記第２ポンプ部のシリンダブロックは前記回転軸に取付けられており、前記相対的回転の回転中心の周りで前記弁手段に対し相対的に回動可能な様に取付けられた斜板は前記回転軸に対し相対的回動可能とされている、ことを特徴とする、斜板式ピストンポンプ、が提供される。

【００１２】本発明の一態様によれば、前記付勢手段は前記各シリンダ内に配置された圧縮バネである。

【００１３】更に、本発明によれば、上記目的を達成するものとして、シリンダブロック内に複数のシリンダが形成されており、該シリンダのそれぞれの内部には第１ピストン及び第２ピストンが収容されており、前記シリンダブロックに対し相対的に回転せしめられる第１斜板及び第２斜板が前記シリンダの軸方向に関し前記シリンダブロックの両側に配置されており、前記第１斜板及び第２斜板のカム面はいずれも前記相対的回転の際に前記各シリンダに対応する部分と該シリンダとの間の距離が該シリンダの軸方向に関し変化する様に形成されており、前記複数のシリンダは前記シリンダブロック内において前記相対的回転の回転中心の周囲において該回転中心の方向を向いて配置されており、前記第１ピストン及び第２ピストンをそれぞれ前記第１斜板のカム面及び前記第２手段のカム面の方へと付勢する付勢手段を有し、前記シリンダブロックに対し相対的に回転せしめられる弁手段を有し、該弁手段には流体吸入経路及び流体吐出経路が形成されており、前記各シリンダの前記第１ピストンと第２ピストンとの間の領域は前記シリンダブロックに形成された流体流通孔を介して前記相対的回転に際し前記流体吸入経路及び流体吐出経路と交互に連通せしめられる様に該流体吸入経路及び流体吐出経路が配置されており、前記第１斜板及び第２斜板のうちの少なくとも一方は前記相対的回転の回転中心の周りで前記弁手段に対し相対的に回動可能な様に取付けられており、該斜板の回動を操作する回動操作手段を有する、ことを特徴とする、斜板式ピストンポンプ、が提供される。

【００１４】本発明の一態様によれば、前記相対的回転の回転中心に沿った回転軸を有し、該回転軸は前記弁手段及び前記第１斜板及び第２斜板に対し相対回転可能な様に取付けられており、前記シリンダブロックは前記回転軸に取付けられており、前記相対的回転の回転中心の周りで前記弁手段に対し相対的に回動可能な様に取付けられた斜板は前記回転軸に対し相対的回動可能とされている。本発明の一態様によれば、前記付勢手段は前記各シリンダ内において前記第１ピストンと第２ピストンとの間に配置された圧縮バネである。

【００１５】以上の様な本発明の一態様によれば、前記回動操作手段は前記斜板の外周部に形成されたウォームギヤと噛み合うウォームを備えているものである。本発明の一態様によれば、前記各ピストンと前記斜板のカム面との間にはこれらに対し転がり又は摺動回転可能な球形状の媒介部材が介在している。

【００１６】更に、本発明によれば、上記目的を達成するものとして、前記の如き斜板式ピストンポンプの構成のうちの前記付勢手段を除去し且つ前記流体吸入経路及び流体吐出経路のうちの一方を流体供給経路となし他方を流体排出経路となしたことを特徴とする、斜板式ピストンモータ、が提供される。

【００１７】

【実施例】以下、図面を参照しながら本発明の具体的実施例を説明する。

【００１８】図１は本発明による斜板式ピストンポンプの第１の実施例を示す分解斜視図であり、図２、図３及び図４はその組立状態の断面図である。

【００１９】これらの図において、２はケーシング胴体部であり、４，６はケーシング蓋体部であり、これらはボルトにより結合され一体化されて、ケーシングを構成している。ケーシング内にはＸ－Ｙ方向を中心とした回転対称の円筒形状の空洞が形成されている。該空洞内に

はＸ－Ｙ方向の回転軸８が配置されている。該回転軸８は、ベアリングを介してケーシング蓋体部４．６により回転可能な様に支持されており、且つＸ方向側の端部がケーシング外へと延出している。該回転軸８は、ケーシング内の部分においてスプライン８Ａを有する。尚、以下の説明において、軸方向、径方向及び周方向とは、特に指示のない限り、いずれも回転軸８に関する方向を指すものとする。

【００２０】上記ケーシング空洞内には、円環形状のシリンダブロック１０が配置されている。該シリンダブロック１０は、中央部に上記回転軸８のスプライン８Ａと係合せるスプライン穴１０Ａを有している。シリンダブロック１０には、回転軸８の回転中心方向に沿って平行に７つのシリンダ１２が形成されている。これらシリンダは回転軸８の周方向に関し均等に配列されている。これらシリンダ１２はそれぞれシリンダブロック１０のＸ方向側の端面にて開口している。また、シリンダブロック１０のＹ方向側の端面には、各シリンダ１２と連通せる流体流通孔１４が形成されている。各シリンダ１２内にはピストン１６が収容されている。各ピストン１６は、シリンダ１２内に収容されている圧縮コイルバネ１８によりＸ方向へと付勢されている。ピストン１６のＸ方向側の端面には球面座が形成されており、該球面座には球体２０が摺動回転可能な様に収容されている。ピストン１６には、上記球面座の底部を通って軸方向の流体流通小孔２２が貫通形成されている。

【００２１】ケーシング蓋体部６は、弁手段としての機能をも有する。即ち、ケーシング蓋体部６のＸ方向側の部分は弁板部材２６として形成されており、該弁板部材２６のＸ方向側の面はシリンダブロック１０のＹ方向側の端面との摺動接触面とされており、ここには上記流体流通孔１４に対応する径方向位置においてそれぞれ周方向に半周近くにわたって溝状に形成された流体吸入開口２８及び流体吐出開口３０が設けられている。これら流体吸入開口２８及び流体吐出開口３０は流体吸入経路及び流体吐出経路を形成している。ケーシング蓋体部６には流体吸入管３２と流体吐出管３４とが結合されており、これら流体吸入管３２及び流体吐出管３４はそれぞれ上記流体吸入開口２８及び流体吐出開口３０と連通している。従って、シリンダブロック１０が回転軸８の周りで回転すると、各シリンダ１２と連通せる流体流通孔１４が上記流体吸入開口２８及び流体吐出開口３０に対し順次交互に連通状態を保って走行する様になっている。上記流体吸入開口２８及び流体吐出開口３０と同等の径方向位置において、これら開口の間には小穴３６．３８が形成されており、これら小穴に連なって形成されている流通経路は回転軸８の支持のためのベアリング部まで延びている。

【００２２】ケーシング空洞内には傾き角度可変の斜板（カム部材）４２が配置されている。該斜板４２はベアリングを介して回転軸８により回動可能な様に支持されている。斜板４２は、Ｙ方向側の面がカム面４２Ａとされており、外周面には周方向に半周以上にわたってウォームギヤ４４が形成されている。該ウォームギヤはウォーム４６と噛み合っており、該ウォームはケーシング外からケーシング胴体部２を貫通して挿入された回動操作部材４８に取付けられている。該回動操作部材４８は、ケーシング胴体部２に対し回動可能な様に支持されており、従ってそれを回動させることにより、斜板４２を回転軸８の周りで回動させることができる。

【００２３】尚、上記斜板カム面４２Ａには、上記圧縮コイルバネ１８によりＸ方向に付勢されたピストン２２の球面座に収容された球体２０が転がり可能な様に当接せしめられている。

【００２４】回転軸８及びシリンダブロック１０は、図４中時計回りに駆動回転せしめられる（但し、図４にはシリンダブロック１０は現れていない）。各シリンダ１２が図４中に示されているM_1 の周方向角度範囲内にある時には、シリンダ１２内のコイルバネ１８の伸長力によりピストン１６及び球体２０がＸ方向に押され球体２０と斜板カム面４２Ａとの当接状態を維持しつつピストン１６及び球体２０がＸ方向へと移動する。そして、いずれかのシリンダ１２が流体流通孔１４を介して流体吸入開口２８と連通している時（即ち、図４に示されているN_1 の角度範囲内にある時）には、流体吸入管３２から流体吸入開口２８を介してシリンダ１２内へと流体（例えば油）が吸入される。また、各シリンダ１２が図４中に示されているM_2 の周方向角度範囲内にある時には、球体２０と斜板カム面４２Ａとの当接状態を維持しつつ斜板カム面４２Ａにより球体２０及びピストン１６がシリンダ１２内のコイルバネ１８の伸長力に抗してＹ方向に押されて移動する。そして、いずれかのシリンダ１２が流体流通孔１４を介して流体吐出開口３０と連通している時（即ち、図４に示されているN_2 の角度範囲内にある時）には、流体吐出開口３０を介して流体吐出管３４へと流体が吐出される。斜板４２がこの様な周方向回転角度位置にある時を、斜板４２の周方向回転角度＝０°であるとする。

【００２５】即ち、ｍを境界として、M_1 側ではシリンダ１２へと流体吸入開口２８から流体が吸入され、M_2 側ではシリンダ１２から流体吐出開口３０へと流体が吐出される。このｍを死点境界角度位置ということにする。

【００２６】図５は、斜板４２の周方向回転角度θを変化させた場合の、ポンプ動作の変化を示す説明図である。図５（ａ）は、斜板４２の周方向回転角度θの取り方を示す図であり、上記周方向回転角度０° の状態から、回動操作部材４８を用いた操作により、図３中半時計周りに回転させた時の角度を周方向回転角度θとする。周方向回転角度θの増加にともない、シリンダ１２

の周方向角度位置における斜板カム面４２Ａとの間の距離が次第に変化する。このため、上記死点境界角度位置mは、図４中時計回りに角度θ回転した位置となる。

【００２７】例えば、角度θが４５°の場合には、死点境界角度位置がm'の様になり、従って流体吸入開口２８に対しては各シリンダ１２がm'より図４中で反時計回り方向の位置にある時にはシリンダ１２から流体吐出がなされ且つ各シリンダ１２がm'より図４中で時計回り方向の位置にある時にはシリンダ１２へと流体吸入がなされる。従って、流体吸入管３２から流体吸入開口２８へは、流体吸入開口２８からシリンダ１２への流体吸入量とシリンダ１２から流体吸入開口２８への流体吐出量との差に相当する量の流体が吸入されることになる。同様に、流体吐出開口３０に対しては各シリンダ１２がm'より図４中で反時計回り方向の位置にある時にはシリンダ１２へと流体吸入がなされ且つ各シリンダ１２がm'より図４中で時計回り方向の位置にある時にはシリンダ１２から流体吐出がなされる。従って、流体吐出管３４から流体吐出開口３０へは、シリンダ１２から流体吐出開口３０への流体吐出量と流体吐出開口３０からシリンダ１２への流体吸入量との差に相当する量の流体が吐出されることになる。

【００２８】かくして、角度θが９０°の場合には、流体吸入開口２８からシリンダ１２への流体吸入量とシリンダ１２から流体吸入開口２８への流体吐出量とが等しくなるので流体吸入管３２から流体吸入開口２８への流体流入はなくなり、流体吐出開口３０からシリンダ１２への流体吸入量とシリンダ１２から流体吐出開口３０への流体吐出量とが等しくなるので流体吐出開口３０から流体吐出管３４への流体吐出もなくなる。

【００２９】角度θが９０°を越えて１８０°までの間は、流体吸入管３２と流体吐出管３４との作用が逆転し、流体吸入管３２へと流体が吐出され、流体吐出管３４から流体が吸入される。

【００３０】図５（ｂ）は、角度θと流体流通量との関係の概略を示すものである。曲線C_1は流体吸入管３２からの流体吸入量を示し（＋は吸入を示しーは吐出を示す）、曲線C_2は流体吐出管３４への流体吐出量を示す（ーは吐出を示し＋は流入を示す）。

【００３１】尚、図５に関する以上の説明では、無限に近い数のシリンダ１２が周方向に無限に小さい間隔で配列されている極限の形態につきモデル化して説明した。

【００３２】本実施例では、流通小孔２２を介して球面座内へと流体が供給されるので、該球面座と球体２０との間の潤滑作用は良好に行われる。また、各シリンダ１２が流体吸入開口２８及び流体吐出開口３０のいずれとも連通しなくなる周方向角度範囲が存在し、これらの角度範囲では特にシリンダ１２からの流体吐出がブロックされることによる動作の不連続性のおそれがあるが、上記実施例では小穴３６，３８を設けることにより上記角度範囲内においてシリンダ１２からの吐出流体を受けている。これにより、ポンプ動作を連続的且つ滑らかに行わせることができるとともに、ベアリングの潤滑をも実現できる。

【００３３】以上の様に、本実施例においては、シリンダブロック１０の回転ための回転軸８に対し斜板４２を回転及び回動可能な様に取付け、該斜板の回転軸８の周りの周方向回転位置を適宜設定することで、容易且つ正確に流体流通量（吐出量）を制御することができる。特に、本実施例では、θ＝０°の近傍において回転角θに対する流通量の変化が小さいので最大流通量の近傍で滑らか且つ精密に流通量を制御することができるという特色がある。また、本実施例では、斜板４２を回転軸８に回動可能に取付けているので、特別の回動軸を設ける必要がなく、所要部材が少なくてすみ、機構が簡単で小型化が容易である。

【００３４】また、以上の様に、本実施例においては、各ピストン１６と斜板カム面４２Ａとの間に球体２０が配置されているので、球体２０がカム面４２Ａから受ける力の方向が厳密にはシリンダ１２及びピストン１６の方向とは異なっていても、シリンダ１２と面接触しているピストン１６には球体２０からシリンダ１２及びピストン１６の方向の力しか加えられないので、ピストン１６の長さが短くともシリンダ１２に対し側圧がかかることは実質上なく、従って、シリンダ及びピストンの摩耗が少なくシリンダーピストン間を通っての流体漏れが発生しにくくポンプ効率は高く維持され振動発生が少なく、しかも小型化が可能であるという作用効果が得られる。

【００３５】図６及び図７は本発明による斜板式ピストンポンプの第２の実施例を示す分解斜視図であり、図８、図９及び図１０はその組立状態の断面図である。これらの図において、上記図１～図５におけると同様の機能を有する部材には同一の符号が付されている。尚、図７は図６の一部（Ｐ－Ｑ部分）を構成するものである。

【００３６】本実施例では、ケーシング空洞内において、Ｘ方向側の第１ポンプ部S_1とＹ方向側の第２ポンプ部S_2との２つの機能部分が配置されている。第１ポンプ部S_1は上記第１の実施例の機能部分と同様の構成を有する。また、第２ポンプ部S_2は斜板がケーシングに対し固定されている点を除いて第１ポンプ部S_1と同様の構成を有する。即ち、第２ポンプ部S_2におけるシリンダブロック１１、スプライン穴１１Ａ、シリンダ１３、流体流通孔１５、ピストン１７、圧縮コイルバネ１９、球体２１、斜板４３及びカム面４３Ａは、それぞれ、第１ポンプ部S_1におけるシリンダブロック１０、スプライン穴１０Ａ、シリンダ１２、流体流通孔１４、ピストン１６、圧縮コイルバネ１８、球体２０、斜板４２及びカム面４２Ａに対応している。但し、第２ポンプ部S_2の斜板４３はケーシング蓋体部６に対し固定され

ている。

【００３７】そして、第１ポンプ部S_1と第２ポンプ部S_2との境界部には、２つのポンプ部で共用されている弁板部材２７がケーシング胴体部２に対し固定されて配置されている。この弁板部材２７のＸ方向側の面及びＹ方向側の面はそれぞれシリンダブロック１０のＹ方向側の端面及びシリンダブロック１１のＸ方向側の端面との摺動接触面とされており、ここには上記流体流通孔１４，１５に対応する径方向位置においてそれぞれ周方向に半周近くにわたって溝状に形成された流体吸入開口２８及び流体吐出開口３０が設けられている。これら流体吸入開口２８及び流体吐出開口３０はＸＹ方向に貫通している。そして、これら吸入開口と吐出開口には、ケーシング胴体部２及び弁板部材２７をＡＢ方向に貫通して、それぞれ流体吸入管３２及び流体吐出管３４が接続されている。上記流体吸入開口２８及び流体吐出開口３０と同等の径方向位置において、これら開口の間には小穴３６，３８が形成されており、これら小穴に連なって形成されている流通経路は回転軸８の貫通せるＸＹ方向の開口部まで延びている。

【００３８】回転軸８は第１ポンプ部S_1と第２ポンプ部S_2とで共用されており、シリンダブロック１０，１１に形成されたそれぞれ５つのシリンダ１２，１３がＸＹ方向に対応して位置する様に、上記シリンダブロック１０，１１が回転軸８に取付けられている。従って、回転軸８の回転にともない、対応するシリンダ１２，１３が同時に流体吸入開口２８及び流体吐出開口３０と連通する。

【００３９】第１ポンプ部S_1の斜板４２の周方向回転角度θの取り方として、カム面４２Ａが図８に示されている様に第２ポンプ部S_2の固定斜板４３のカム面４３Ａと対称的な配置にある時を０°とすると、周方向回転角度θの変化とポンプ動作の変化との関係は図１１に示す様になる。曲線C_1は流体吸入管３２からの流体吸入量を示し（＋は吸入を示し－は吐出を示す）、曲線C_2は流体吐出管３４への流体吐出量を示す（－は吐出を示し＋は流入を示す）。角度θが１８０°になると、第１ポンプ部S_1の斜板カム面４２Ａと第２ポンプ部S_2の斜板カム面４３Ａとの間隔が全ての周方向角度において一定になり、従って、回転軸８及びシリンダブロックが回転しても、対応するピストン１６，１７の間隔が変化しなくなるので、流体吸入開口２８からシリンダ１２，１３への流体吸入及びシリンダ１２，１３から流体吐出開口３０への流体吐出はなくなり、流体吸入管３２から流体吸入開口２８への流体流入及び流体吐出開口３０から流体吐出管３４への流体吐出はなくなる。

【００４０】尚、図１１では、無限に近い数のシリンダ１２が周方向に無限に小さい間隔で配列されている極限の形態につきモデル化して説明した。

【００４１】本実施例においても、上記第１の実施例と同様の作用効果が達成される。本実施例では、角度θが０°～１８０°の範囲において、流体吸入管３２から流体を吸入し、流体吐出管３４から流体を吐出させることができる。また、本実施例の場合には、上記第１の実施例の２倍の流量が得られる。尚、本第２の実施例において、上記第２ポンプ部S_2の斜板４３を第１ポンプ部Ｓ１の斜板４２と同様に回動可能なものとすることもできる。

【００４２】図１２及び図１３は本発明による斜板式ピストンポンプの第３の実施例を示す分解斜視図であり、図１４及び図１５はその組立状態の断面図である。これらの図において、上記図１～図１１におけると同様の部材には同一の符号が付されている。尚、図１３は図１２の一部（Ｐ－Ｑ部分）を構成するものである。

【００４３】本実施例では、上記第２の実施例において用いられていた弁板部材２７を除去し、代わりに、２つのシリンダブロックならびに該シリンダブロック内の対応するシリンダ及び該シリンダ内の圧縮コイルバネを共通一体化している。即ち、１つのシリンダブロック１０の各シリンダ１２内に第１及び第２のピストン１６，１７を収容し、これら対応するピストンの間のシリンダ内領域に１つの圧縮コイルバネ１８を配置している。そして、上記第２の実施例において用いられていた流体吸入開口及び流体吐出開口の代わりとしての流体吸入溝２９及び流体吐出溝３１をケーシング胴体部２の内面にそれぞれ周方向に半周近くにわたって形成し、これらに対応する軸方向位置において、シリンダブロック１０には各シリンダの第１及び第２のピストン１６，１７間の領域と連通せる流体流通孔１５が形成されている。そして、上記流体吸入溝２９及び流体吐出溝３１には、ケーシング胴体部２を貫通して、それぞれ流体吸入管３２及び流体吐出管３４が接続されている。

【００４４】本実施例においても、上記第２の実施例と同様の作用効果が達成される。更に、本実施例では、弁板部材を省略して弁手段をケーシング胴体部２に形成しているので、部品点数が少ない。

【００４５】以上、回転軸８を駆動回転せしめて流体吸入管３２から流体を吸入し流体吐出管３４から流体を吐出するピストンポンプの実施例を説明したが、これらピストンポンプにおけるピストン付勢のための付勢手段たる圧縮コイルバネを除去し且つ流体吸入管３２及び流体吐出管３４のうちの一方から高圧流体を導入し他方から流体を排出することにより回転軸８を出力軸として回転させるピストンモータを構成することができる。この様なピストンモータにおいては、上記ピストンポンプの各実施例につき説明した作用効果における流量制御を回転数制御に置き換えたものと同様の作用効果が得られる。

【００４６】

【発明の効果】以上の様に、本発明の斜板式ピストンポンプや斜板式ピストンモータによれば、シリンダブロッ

クと斜板及び弁手段との相対的回転の回転中心の周りで上記斜板を上記弁手段に対し相対的に回動可能な様に取付け、上記斜板のための回動操作手段を備えているので、上記斜板を回動させその周方向角度位置を調節することにより、流量あるいは回転数を容易且つ正確に制御することができる。

【００４７】特に、本発明によれば、最大流体流通量の近傍で滑らか且つ精密に流体流通量を制御することができる。

【００４８】また、本発明によれば、斜板を回転軸に回動可能に取付けることにより、特別の回動軸を設ける必要がなく、所要部材が少なくてすみ、機構が簡単で小型化が容易である。

【図面の簡単な説明】

【図１】本発明による斜板式ピストンポンプの第１の実施例を示す分解斜視図である。

【図２】本発明による斜板式ピストンポンプの第１の実施例の組立状態の断面図である。

【図３】本発明による斜板式ピストンポンプの第１の実施例の組立状態の断面図である。

【図４】本発明による斜板式ピストンポンプの第１の実施例の組立状態の断面図である。

【図５】本発明による斜板式ピストンポンプの第１の実施例において斜板の周方向回転角度を変化させた場合のポンプ動作の変化を示す説明図である。

【図６】本発明による斜板式ピストンポンプの第２の実施例を示す分解斜視図である。

【図７】本発明による斜板式ピストンポンプの第２の実施例を示す分解斜視図である。

【図８】本発明による斜板式ピストンポンプの第２の実施例の組立状態の断面図である。

【図９】本発明による斜板式ピストンポンプの第２の実施例の組立状態の断面図である。

【図１０】本発明による斜板式ピストンポンプの第２の実施例の組立状態の断面図である。

【図１１】本発明による斜板式ピストンポンプの第２の実施例において斜板の周方向回転角度を変化させた場合のポンプ動作の変化を示す説明図である。

【図１２】本発明による斜板式ピストンポンプの第３の実施例を示す分解斜視図である。

【図１３】本発明による斜板式ピストンポンプの第３の実施例を示す分解斜視図である。

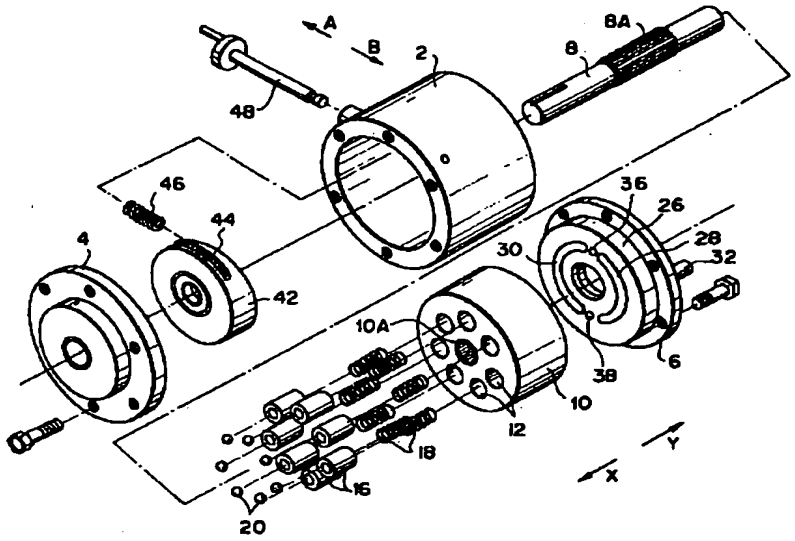
【図１４】本発明による斜板式ピストンポンプの第３の実施例の組立状態の断面図である。

【図１５】本発明による斜板式ピストンポンプの第３の実施例の組立状態の断面図である。

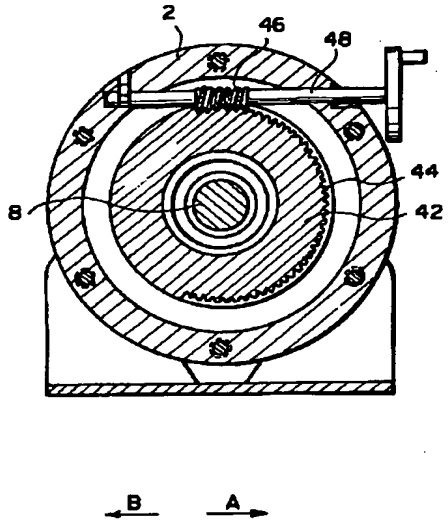
【符号の説明】

２　　ケーシング胴体部
４，６　　ケーシング蓋体部
８　　回転軸
８Ａ　　スプライン
１０，１１　　シリンダブロック
１０Ａ，１１Ａ　　スプライン穴
１２，１３　　シリンダ
１４，１５　　流体流通孔
１６，１７　　ピストン
１８，１９　　圧縮コイルバネ
２０，２１　　球体
２２　　流体流通小孔
２６，２７　　弁板部材
２８　　流体吸入開口
２９　　流体吸入溝
３０　　流体吐出開口
３１　　流体吐出溝
３２　　流体吸入管
３４　　流体吐出管
４２，４３　　斜板
４２Ａ，４３Ａ　　斜板カム面
４４　　ウォームギヤ
４６　　ウォーム
４８　　回動操作部材
S_1　　第１ポンプ部
S_2　　第２ポンプ部

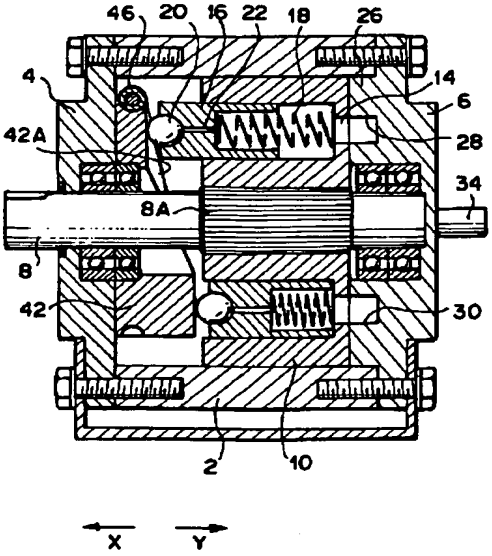
【図１】


A
B
2
8A
8
48
46
44
4
42
36
26
28
30
32
10A
38
6
10
12
18
16
20
Y
X

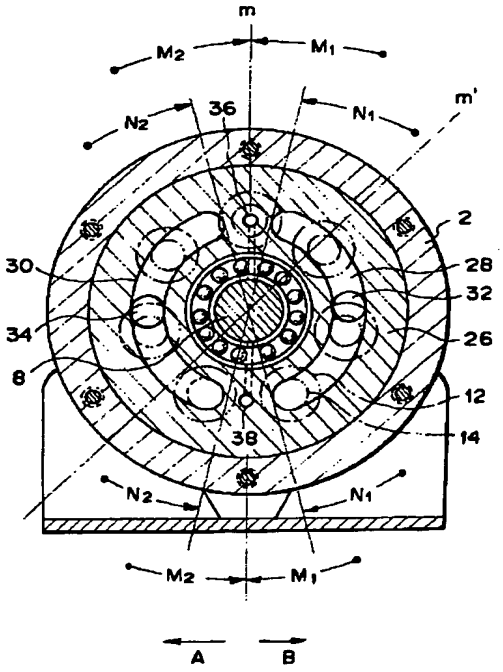
【図３】


2
46
48
44
8
42
B
A

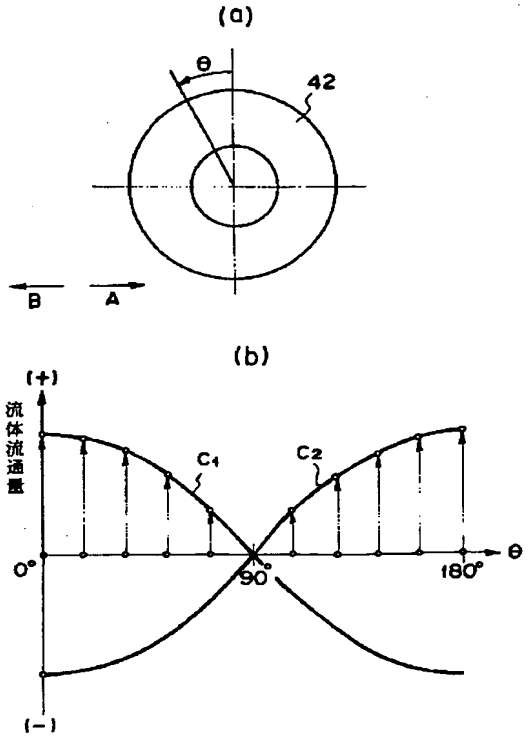
【図２】


46
20
16
22
18
26
4
14
6
42A
28
34
8A
8
42
30
2
10
X
Y

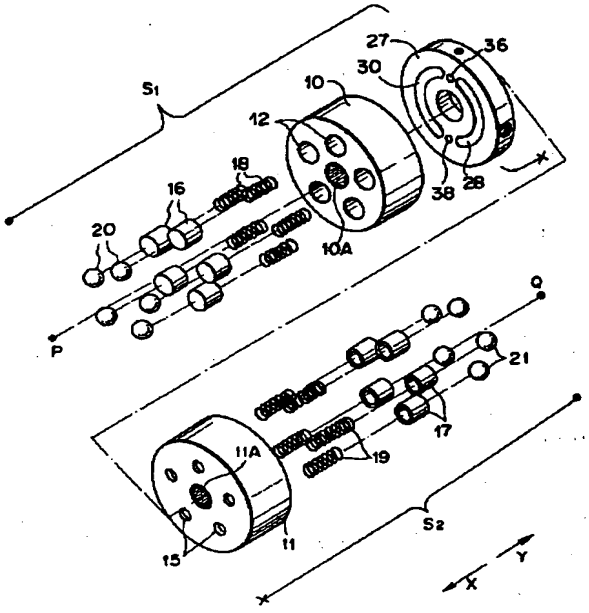
【図４】


m
M2
M1
N2
36
N1
m'
2
30
28
32
34
26
8
12
14
38
N2
N1
M2
M1
A
B

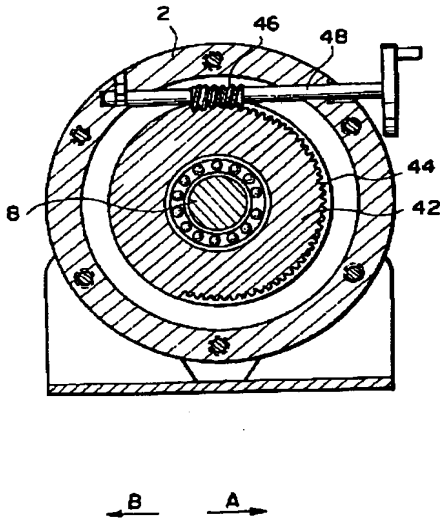
【図５】


(a)
θ
42
B
A
(b)
(+)
流体流通量
C1
C2
0°
90°
180°
θ
(−)

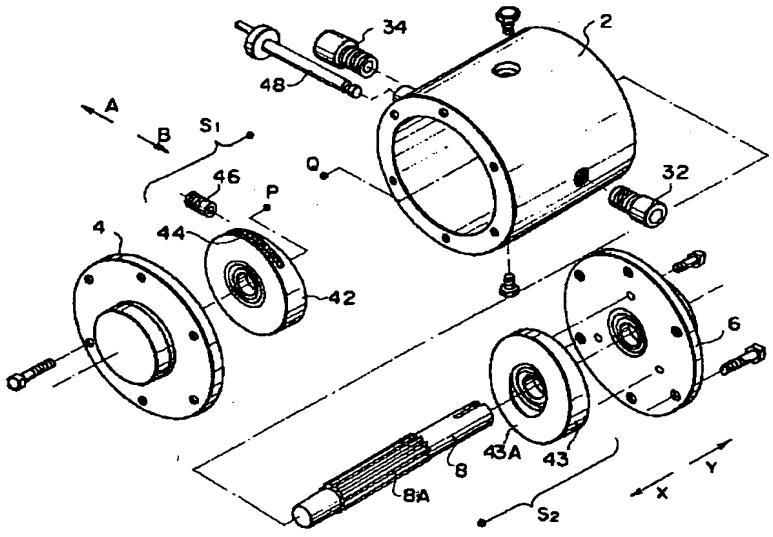
【図７】


S1
27
36
30
10
12
18
16
20
38
28
10A
P
Q
21
17
19
11A
11
15
S2
X
Y

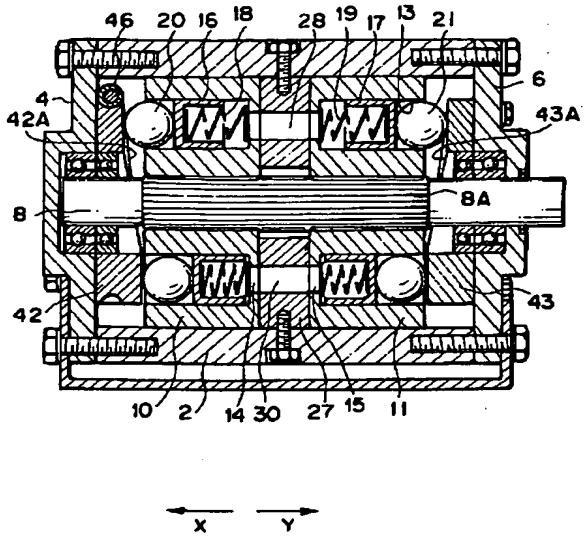
【図９】


2
46
48
44
8
42
B
A

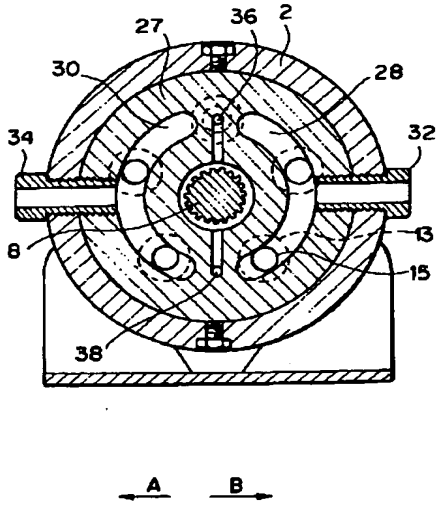
【図６】


34
48
2
A
B
S1
46
P
Q
32
4
44
42
6
8
43A
43
8A
S2
X
Y

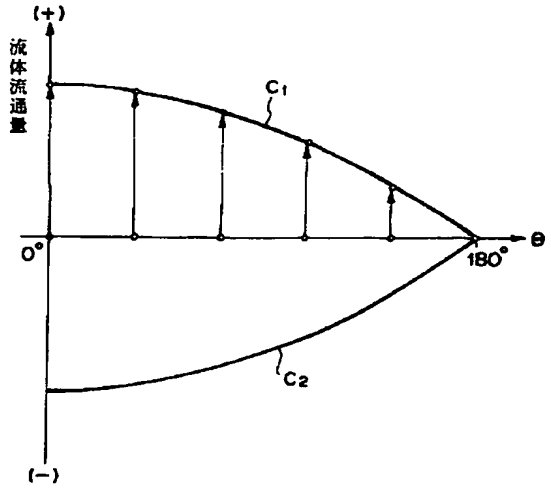
【図８】



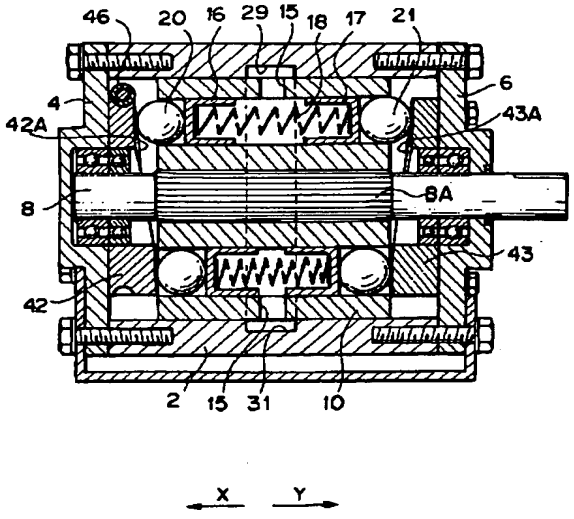
【図１０】



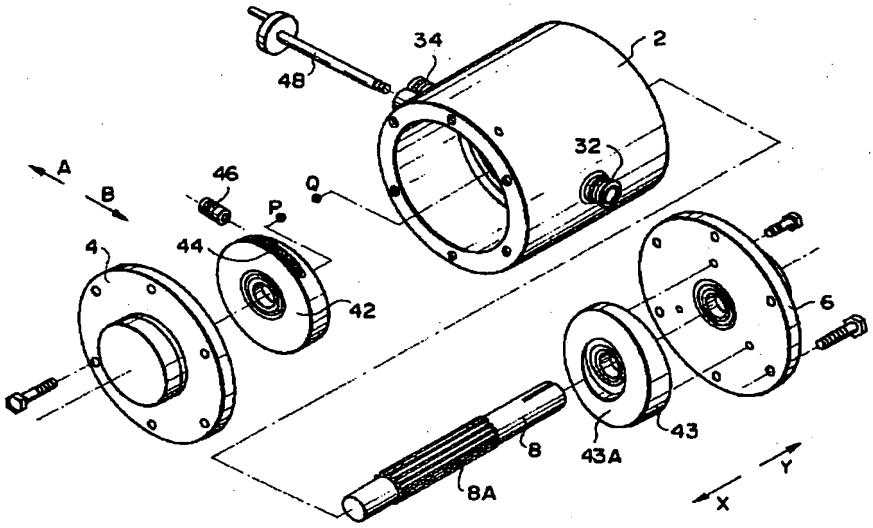
【図１１】



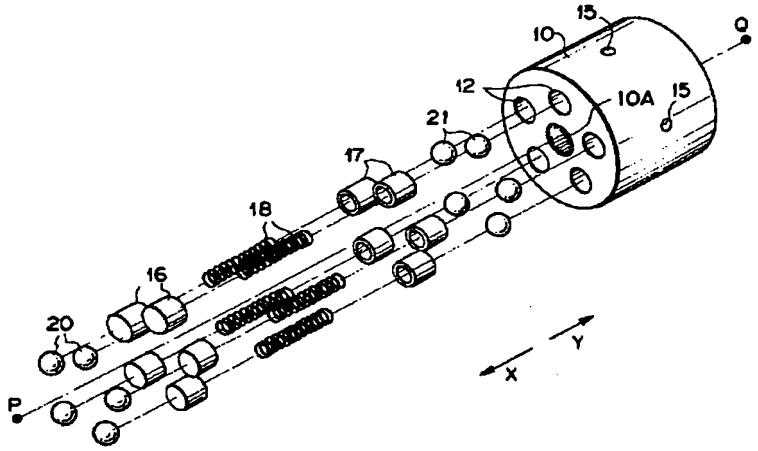
【図１４】



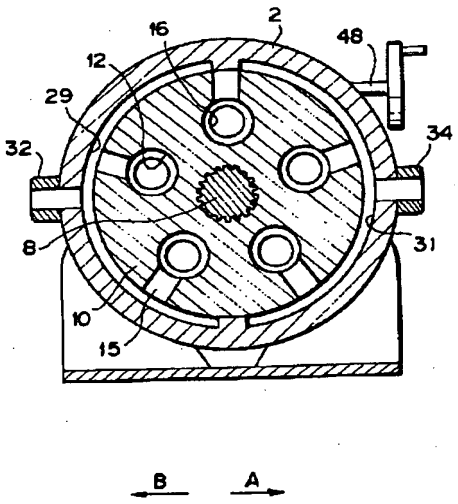
【図１２】


34
48
2
32
A
B
46
Q
P
44
4
42
6
43
43A
8
8A
Y
X

【図１３】


15
10
Q
12
10A
15
21
17
18
16
20
P
Y
X

【図１５】


16
2
48
12
29
32
34
8
31
10
15
B
A